DOCUMENT RESUME

ED 222 390 SE 039 495

AUTHOR LaHart, David, Ed.
TITLE Sunny Side Up in Social Studies.
INSTITUTION Seminole County Board of Public Instruction, Sanford, Fla.
SPONS AGENCY Florida State Dept. of Education, Tallahassee. Office of Environment Education.
PUB DATE Sep 81
NOTE 120p.; For related documents, see SE 039 493-496.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Conservation Education; Elementary Secondary Education; *Energy; *Energy Conservation; Environmental Education; *Interdisciplinary Approach; *Learning Activities; Life Style; Middle Schools; *Social Studies; *Solar Radiation
IDENTIFIERS *Energy Education; Florida

ABSTRACT

Solar energy lessons for grades 6, 7, and 8 social studies classes are provided in this guide. Each lesson includes appropriate grade level(s), objectives, activities, and strategies for introducing and developing the lesson. In the first five lessons (the social scientist and conservation), students are introduced to the role of the social scientist by completing activities concerned with today's social problems. Students identify problems and the social scientist's role in solving them. Topics addressed in other lessons include: fuels; population and energy supply; solar energy research; energy ads; Florida climate; solar energy and climates; energetic locations; wind power; energy to get energy; energy and civilization; north wind and sun; solar folks; solar energy and ancient Greeks/Romans; solar energy--past and present; life with limited energy; lifestyles and energy; changing life patterns; changing societies; solar energy--people and sun; American Indians and the sun; energy conflict; energy on the farm; solar energy and exploration; solar energy and the American colonial period; solar inventions; energy, environment, and man; sun's influence on man's dwellings; energy demand and population; developing nations; and energy use in nations of the world. Rationale for including energy in social studies and teacher background information on the sun are also provided. (JN)

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SUNNY SIDE UP in SOCIAL STUDIES

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SUNNY SIDE UP IN SOCIAL STUDIES

Bettie Palmer
Project Director
Seminole County Schools

David LaHart
Editor
Florida Solar Energy Center

Illustrations by:

Carol Gentry
Lake View Middle School

Sunny Side Up was partially supported by a 1980-81 Environmental Education Mini-grant from the Florida Department of Education.

September
1981

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ACKNOWLEDGEMENTS

Many people are responsible for Sunny Side Up. Seminole County teachers worked long and hard to produce the curriculum in Language Arts, Mathematics, Science, and Social Studies. Carol Gentry provided the abundance of excellent illustrations and Eileen Dunn supervised typing and retyping the manuscripts. But there are many others who helped. Dick Tillis and Jim Phillips from Florida's Office of Environmental Education provided the funding and made many valuable suggestions during the project. Rosalyn Tillis generously supplied an abundance of publications from the Governor's Energy Office.

We borrowed ideas, activities and even some illustrations from other energy education materials including:

Solar Energy Project developed for the U. S. Department of Energy by the New York State Education Department, Bureau of Science Education;

Solar Energy I and II from the American Museum of Science and Energy, Oak Ridge Associated Universities;

Energy and My Environment by Matt Brennan, published by the Florida's Governor's Energy Office, and;

Solar '80's by David LaHart which is published by the Florida Solar Energy Center. Copyrighted material was included only when proper permission could be obtained.

Sunny Side Up is symbolized by Sunny Solar, an all knowing critter who has not lost the common touch. Notice the bad tennis shoes! Professor, hard hat, adventurer or politician, Sunny is always helping us along the path to energy knowledge. We hope you enjoy Sunny while you are learning about energy.

David E. LaHart
Cape Canaveral

SOLAR ENERGY AND THE SOCIAL STUDIES - WHO NEEDS IT?

Can you imagine early civilizations without sun gods?

Can you imagine the Amazon Basin without a rain forest?

Can you imagine early American colonists without log cabins?

Without solar energy it would not be necessary to imagine these things -- they would be FACTS!

All that people do require energy: the very existence of life in our tissues, and in the tissues of all living things, requires energy. And the greatest and most overwhelming single source of this necessary energy is the sun.

The history of civilization is, to some extent, the tale of the discovery of new and more efficient ways of handling energy. Through most of history, people could do no more than other animals -- make use of the energy from our straining muscles. Even with ingenious inventions like needles, axes, and bows, it was muscular effort that forced them into motion (and without motion, all such devices are useless.)

On some long-forgotten day in prehistory, we learned not to fear fire and even learned how to start one. The energy of fire comes from the combination of carbon in fuel with oxygen in the air. The first fuel was wood, which consisted of high-energy cellulose and other compounds formed by plants using solar energy.

Coal, petroleum, and natural gas are all remnants of plant life that dwelt on earth many millions of years in the past. They are fossil fuels and, in using them, mankind is drawing on the capital that was laid down by countless generations of plants that had used solar energy.

SOLAR ENERGY AND THE SOCIAL STUDIES - WHO NEEDS IT?

Solar energy warms the earth's atmosphere and gives rise to the winds. It evaporates ocean water by the cubic mile and produces the rain and all the flowing rivers. People learned to use the wind to blow ships over the waters, and the river currents to float them down stream. We even used wind and water to turn wheels that would grind grain. The wind, however, is erratic, and waterpower exists in quantity only in certain parts of the world, and not always in the most populated parts.

So what does this all have to do with the Ancient Egyptians, the Amazon Basin and the early American colonists? A World History teacher has the responsibility to explain how the sun has been extremely important in the development of civilizations. The Geography teacher has the responsibility to show how countries should work together to develop their solar energy potentials. The American History teacher has the responsibility to illustrate the role that the sun has played in the development of the American culture. It is today's student who will make the decisions about our energy future tomorrow.

All of us have the responsibility to develop new attitudes about energy and how they relate to life on this planet. SOLAR ENERGY - WHO NEEDS IT? WE ALL DO!

SOCIAL STUDIES TEACHER BACKGROUND MATERIAL

OUR ENERGY SOURCE - THE SUN

Our sun is just one of the countless number of stars found in the universe. As far as stars go, it is not really very noteworthy. However, as far as life on this planet goes, it is all-important. It is certainly not the largest nor the smallest, the oldest nor the youngest, the hottest nor the coldest. Astronomers classify it as a "main sequence", spectral class "G" star. Stated simply, this means that our sun is an average run-of-the-mill star with a good many years of life still remaining. For about five billion years the sun has been providing the earth with nearly all of its energy; we can count on it to do so for the next five billion years. It is the only star close enough to enable scientists to study it in rather fine detail.

The earth revolves around the sun in an elliptical orbit at a distance of approximately 93 million miles. At this distance, it takes light and other radiant energy from the sun about eight and one-half minutes to reach the earth. Because of the slight eccentricity of the earth's orbit, we are somewhat closer to the sun during winter months than in summer. The sun and the moon, when viewed in the sky, appear to be approximately the same size; roughly, they appear to have an angular diameter of about 1/2°. However, the moon is only 240,000 miles away. When one realizes that the diameter of the sun is about 864,000 miles or over three times the distance from the earth to the moon, one begins to appreciate how large the sun really is. The volume of the sun about 1,300,000 times that of the earth. The mass of the sun can be determined by measuring its gravitational effect on the earth and is found to be about 2×10^{30} kilograms or about 330,000 times that

of the earth. Knowing the mass and the volume, one can calculate the sun's average density; this turns out to be 1.4 grams/cubic centimeter. On earth this would normally suggest either a material in the solid or liquid state. However, under extreme pressure and temperature, gases also have densities of this order. Pressure in the interior of the sun probably reaches 1×10^{12} pounds/inch^2, while you will recall that normal atmospheric pressure on the earth is about 14.7 pounds/inch^2.

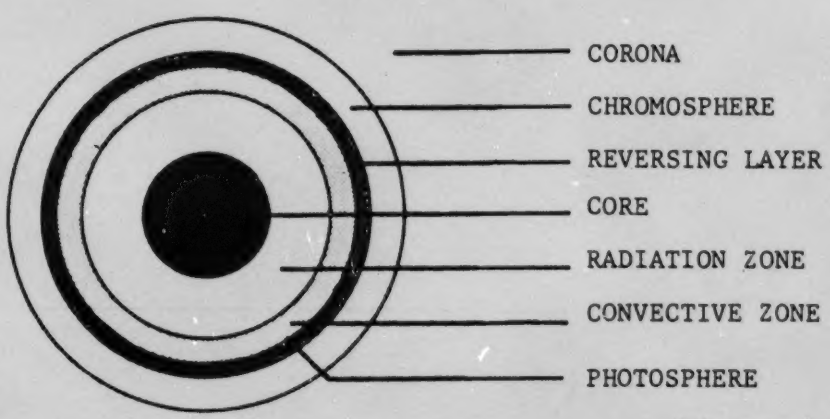
The sun, like the earth, rotates on its axis from west to east. The sun's equator is inclined about 7° to the plane of the ecliptic (the ecliptic is the apparent path of the sun as it moves through the sky among the other stars). Unlike the earth its period of rotation varies with latitude; the period of rotation on its equator (0° latitude) is slightly less than 25 earth days. The period increases to about 33 days in its polar regions. These differences are possible because of the gaseous nature of the sun. Such periods can be determined by studying the doppler shift with a spectroscope or, for that matter, by merely observing the movement of sunspots across the face of the sun.

The sun is made up of various layers; the boundaries are rather indistinct and represent areas where certain dynamic processes give way to others. The part of the sun that we see is called the photosphere. It is a relatively thin layer about 200 or 300 miles thick. Study of this "surface" using proper filters reveals bright granular areas 300-600 miles in diameter surrounded by a darker background. These are not permanent features and last only for a few minutes. The patterns are probably caused by hot gases moving upward at a

velocity of about 1 mile/second while surrounded by cooler, darker looking gases. The temperature of the photosphere is about 6000°K (°K stands for degrees Kelvin). A Kelvin degree is the same size as a Celsius degree; however, the Kelvin or absolute temperature scale starts out at absolute zero, or -273°C. (°C = °K = 273°). The density of the photosphere is perhaps about 1/1000 that of the earth's atmosphere at sea level.

Directly beneath the photosphere is the convective zone. This layer, about 50,000 miles thick, is racked with violent convective currents transferring energy up from the radiation zone. The radiation zone extends downward towards the core. Here energy is transferred upward chiefly by waves of radiation traveling at the speed of light (186,000 miles/second). By the time we reach the core, we find temperatures in the neighborhood of 16,000,000°K (25,000,000°F) and pressures one hundred billion times larger than atmospheric pressure on earth. It is here that continuous thermonuclear reactions occur. Before discussing these reactions, the source of the sun's energy, let us examine the outer layers of the sun.

STRUCTURE OF THE SUN



(Diagram not drawn to scale)

SOCIAL STUDIES TEACHER BACKGROUND MATERIAL
OUR ENERGY SOURCE - THE SUN

Just above the photosphere is a cooler layer (about 5000°K) called the reversing layer. It is called this because it absorbs and then reradiates some of the energy passing through it in all directions. Such absorption results in the characteristic dark-line spectra (Fraunhofer lines) seen against the continuous spectrum produced by the photosphere. These are observed and photographed in spectrographic studies of the sun. Helium was first discovered on the sun in this way. Absorption spectra show that approximately 70 elements exist on the sun. The five most abundant elements are hydrogen (90%), helium (10%), oxygen (.06%), nitrogen (.03%), and carbon (.02%).

Moving still outward we find the region known as the chromosphere. This extends about 6000 miles or more above the photosphere. When special equipment is used to block out the bright background light from the photosphere, this reddish-appearing region can be seen. The color is due to the most abundant gas, hydrogen, found in the region. Hydrogen gas has a strong red spectral line. Most of the gas in the upper part of the chromosphere is ionized. (Ions are atoms which have lost or gained electrons and therefore carry an electric charge.) The temperature in the upper reaches of the chromosphere is high (100,000°K or higher). However, the pressure is very low.

Finally we reach the corona. This pale white halo extends one or two sun diameters beyond the sun and can be readily seen during a total solar eclipse. It can also be observed at other times using a coronagraph. The corona appears to be made up of charged particles (protons especially) streaming away from the sun at velocities of several thousand miles per second. Here the temperature is very high, 1 million degrees

°K. However, the pressure is exceedingly low creating an almost perfect vacuum. Consequently, this temperature is a kinetic temperature based on the average kinetic energy of the moving particles. The equilibrium radiation temperature of an object placed in the corona would be much lower; in fact, it would be extremely cold were it not for energy received by radiation from the photosphere. The so-called "solar wind" is believed to be merely an extension of the corona reaching out beyond earth and the other planets of our solar system.

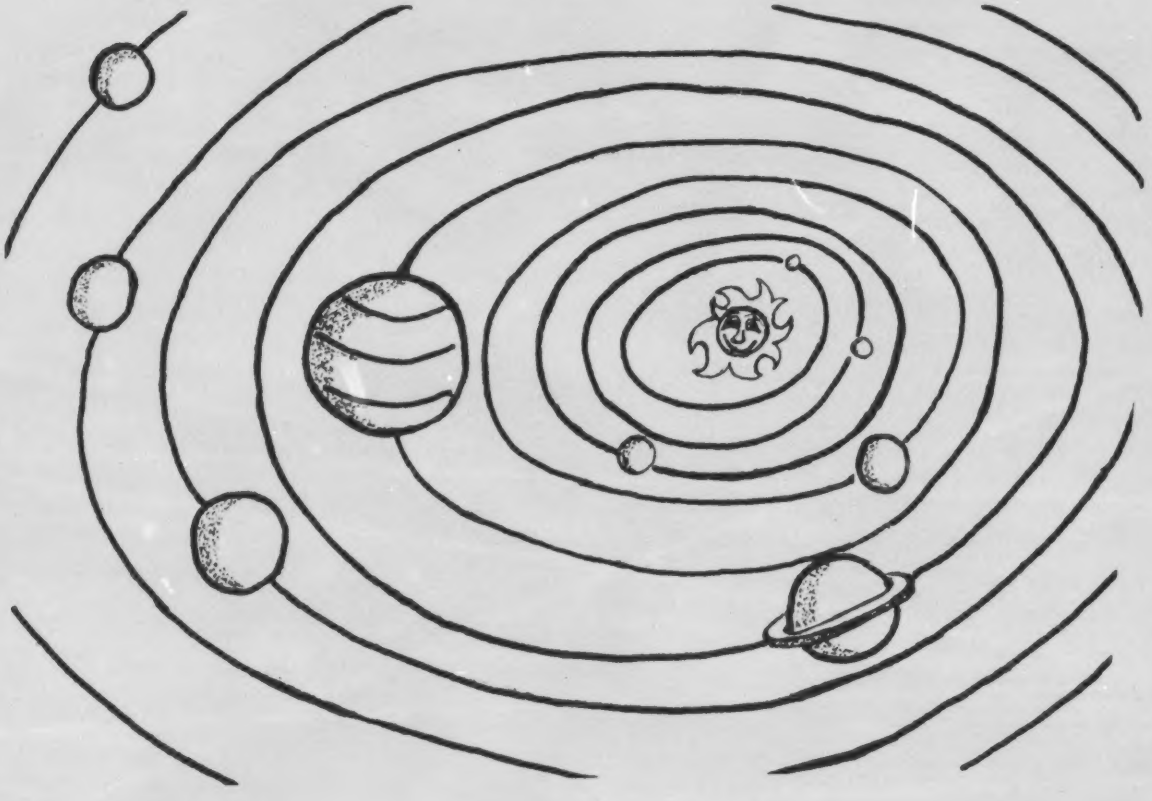
A number of dynamic transitory phenomena are observed occurring at various levels in the solar atmosphere. Sunspots, which appear as slightly darker areas on the sun's surface, may develop especially in a narrow region about 40° north or south of the equator. These appear to follow an 11 year cycle in which solar activity rises and then falls. Smaller sunspots are about the size of the earth; larger ones could hold thousands of earths.

Prominences, condensed streams of hot luminous gases, can be seen at times extending thousands of miles into the corona. When seen against the background of the sun they appear as darker filaments, often taking on an arch shape as they loop back to the surface. These relatively long-lived phenomena seem to originate near sunspot groups. Flares are bright, short-lived phenomena reaching their greatest intensity in a matter of minutes and lasting, perhaps, as long as an hour. They usually originate from plage, bright areas bordering sunspots.

One flare may release as much energy as one billion hydrogen bombs. If it were not for our earth's protective magnetic field and atmosphere, a single solar flare could

wipe out all life on earth with its x-ray and ultraviolet rays. On the surface of the sun, small bright spots have been identified in x-ray studies. These are scattered over the surface of the sun and are not restricted to certain regions as sun spots are. They appear to be associated with the solar corona, great explosions have been recently observed; these have been called "coronal transients". Huge quantities of materials, hundreds of thousands of tons, are hurled outward into space at enormous velocities.

It can be seen that our nearest star is in a constant state of transformation. It is fortunate that the earth is far enough from this violent rotating sphere of gases to enjoy a continual stream of radiation at intensities that are both safe and essential to life.



THE SOCIAL SCIENTISTS AND CONSERVATION

The following five units introduce the roles of the Social Scientists and contain student activities which are concerned with today's social problems. These units are designed for sixth and eighth grade Social Studies classes.

It is the student's responsibility to identify these problems and the social scientists' role in solving such problems. Prior to the study of these units the students should be aware of the specific tasks of each of the social scientists.

A major thrust of American invention in the last decade of the nineteenth century and for most of the twentieth century was toward the development of the suburb, which was an outgrowth of the single-passenger automobile. This unit tells why and how American small towns declined as a result of the availability and acceptance of automobiles, and it tells of the growth of suburbs and their effect on the city. The learning activities also relate the story of the demand for cars and explain the drain on the cities' sense of space, clean air, and safe streets. The great demand for cars strained the resources of many cities and small towns and called for a reconsideration of the balance that now exists between the needs of American society and its wants. The consequences of replacing the number of cars in this country every 11 years -- there are now more than 100 million cars on the roads in the United States -- are many. Air pollution, for instance, can damage trees and plants and aggravate human lungs.

THE SOCIAL SCIENTISTS AND CONSERVATION

Traffic snarls and insufficient parking spaces continue to plague city governments who need the taxes of city workers; and finally, but by no means last in priority, there is the strain the car places on our available energy resources. In this unit, students will become acquainted with some of the implications of supply and demand on prices, on choices, and on lifestyle. They will end the unit by discussing some possible solutions to our energy problem in urban transportation.

GETTING THERE

OBJECTIVES

Students should be able to:

1. Calculate passenger miles per gallon for various vehicles carrying different loads.
2. Explain the difference between miles per gallon (mpg) and passenger miles per gallon (pmpg).
3. Discover some of the advantages of urban mass transportation systems and predict some trends for these systems and the single-passenger automobile.

INTRODUCING THE LESSON

We begin this lesson with a topic that has wide appeal for students -- making a wish come true. Here the student can pick any car he or she wishes, the zingier the better, with money no object. It is later in the progress of the lesson that we let the student see the miles per gallon rate for his dream car. Since our game rule says he or she must be able to afford to run his dream car, some revised thinking may be in store. Facts drawn from charts and tables will help students draw more exact conclusions and sharpen their judgement.

DEVELOPING THE LESSON

Begin the lesson with a topic many students know best -- the family car. You may wish to introduce a lively debate with questions similar to these:

GETTING THERE

Suppose you could buy any new car or van you like. Money is no object. What kind would you pick? Keep one thing in mind, however. After you "buy" your dream car, you have to be able to pay for the gas, oil, and all repairs. Have students make their selections. They may call out their car, or you may wish to have them write them on the board or on paper.

"What features on an auto are the most important to you?" Have students list these as general topics, then you may call for a vote of agreement on each one. How many of you think this feature is important? Take count, then proceed to the next feature. Students will probably mention some or all of the following:

_____Good-looking paint job
_____Sporty lines
_____Whitewalls
_____Air conditioning
_____Good gas mileage
_____Vinyl top
_____Engine reliability
_____Powerful engine
_____Convertible
_____Big size
_____Four-speed transmission
_____Designer interiors (customized vans, denim upholstery, Pucci, etc.)

Suggest to the students that they think about their "dream" car again. Ask, "Why did you pick this car? What would you use it for?" As students think about these questions and make suggestions, distribute the chart showing the names of 1981 cars, and ask students to find their "dream" car on the list. (If they cannot find it, have them choose a car from the list that is a good second choice for them.)

Have students read the heading before answering the following questions:

What is the gas mileage rate for your car? If new regulations came out saying that cars must get 20 miles to the gallon, does your car qualify? How much would gasoline cost you each week for your car, if gasoline costs $1.60 cents a gallon, and you travel 250 miles a week? Have students figure their costs.

GETTING THERE

Suppose your car gets 20 MPG. Divide the number of miles traveled -- 250 divided by 20. This result will be the number of gallons used. Then multiply that figure by $1.60 (250 divided by 20 multiplied by $1.60 = $20.00). What will your "dream" car gasoline costs be?

Conclude this part of the lesson by suggesting the following question: "Can you afford your dream car?" Many students will be reluctant to give up their dream. Use this opportunity to introduce students to a consideration of alternate transportation systems. Should we begin to think of a car as transportation rather than a "dream machine?" Why are there so few mass transportation systems in American cities? What are some advantages in using buses, commuter trains, and airplanes? How would more automobiles cause more city problems?

Have students consider the concept of passenger miles per gallon. This term refers to the number of people that can be carried by an amount of fuel for one mile. PMPG is figured by dividing the number of people in the carrier into the amount of fuel used by the carrier. Once you have helped the students understand this, you can then lead them to consider the relationship between the single-passenger car and efficiency.

Distribute the tables (1 and 2). Ask the students, "Which is the most efficient type of transportation? The least efficient? How can we determine efficiency?" Keep the focus on efficiency by asking: "Would the same amount of gasoline used to carry one individual in the average commuting automobile carry at least 10 persons the same distance in a bus, train, or jet airplane?"

Have students study the charts, then answer the questions.

TABLE I

TYPES OF URBAN TRANSPORTATION	FUEL MILEAGE (AVERAGE MPG= Miles Per Gallon)
Automobile	18.0 MPG
Van	16.0 MPG
Bus	3.3 MPG
Commuter Train	0.1 MPG
DC Jet	0.25 MPG

TABLE II

FORM OF TRANS-PORTATION	NUMBER OF PEOPLE	MPG	FUEL NEEDED FOR 20 MILE TRIP (IN GALLONS)	FUEL PER PERSON (PMPG)
Car	1	18	1.11	1.11
Car	2	18	1.11	0.56
Car	4	18	1.11	0.28
Van	1	16	1.25	1.25
Van	2	16	1.25	0.630
Van	8	16	1.25	0.165
Bus	5	3.3	6.1	1.2
Bus	20	3.3	6.1	0.31
Bus	40	3.3	6.1	0.15
Train	1000	.1	200	0.20
Airplane	100	.25	80	0.80

REMEMBER: Passenger miles per gallon is arrived at by dividing the number of people into the amount of fuel used per mile.

GETTING THERE

TABLE I:

1. Which type of urban transportation listed on Table I gets the most miles from each gallon of gasoline? (Automobile)

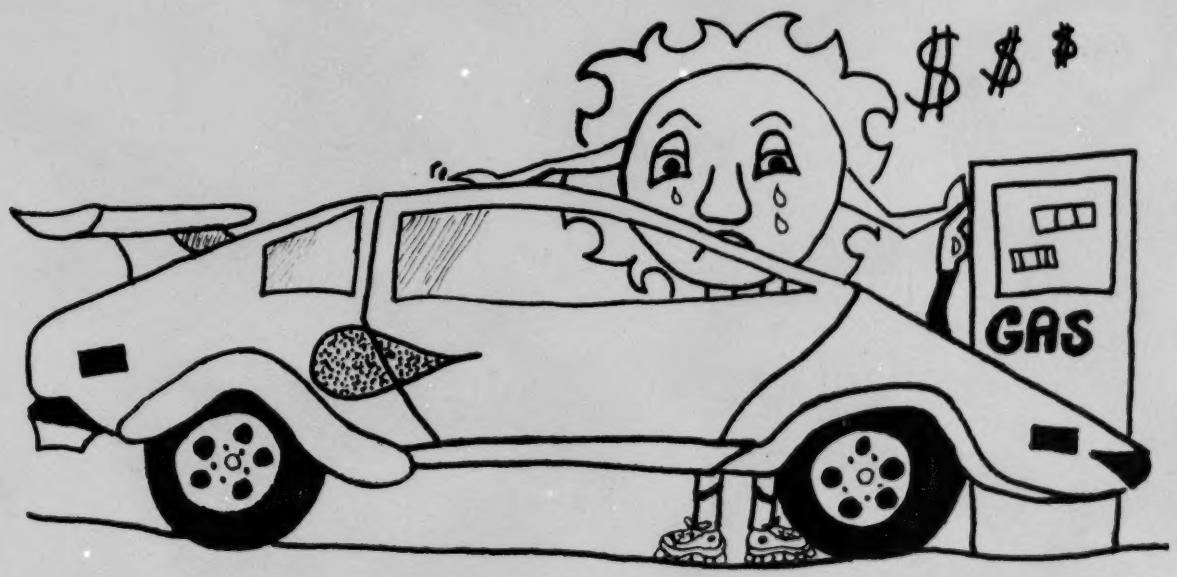
TABLE II:

2. Which vehicle gets the most miles per gallon (MPG)? (Automobile)
3. Which uses the most fuel for a 20 mile trip into the city? (Train)
4. Which uses the most fuel per person for a 20 mile trip into the city? (Van with one person)
5. Which uses the least amount of fuel per person for this trip? (Bus with 40 persons)
6. If the 1,000 people who rode on the commuter train drove a car to the city instead, how much additional fuel would be used? (1,000 persons would use 1,110 gallons of gasoline, compared to 200 gallons, so an additional 910 gallons would be used.)
7. How much fuel is saved by having 40 people ride a bus instead of using 20 cars with two people in each car? (22.2 gallons instead of 6.1 gallons -- so 16.1 gallons of fuel are saved.)

Write a summary paragraph for each question below:

1. Are mass transit systems, like buses and commuter trains, always more efficient than cars? Explain. (Mass transit types of transportation are energy efficient when they are running with large loads.)

2. Suppose the mayor of your city appointed you as the new director of mass transit systems. The mayor wants your ideas on the serious problem of too many cars in the city and the underused public transportation facilities. What would you say in a letter to the mayor? (Encouraging people to use mass transit facilities continues to be very difficult. In theory, people should turn to mass transit facilities because they are more energy-saving. In fact, people will not use them until they can save time and money, and have greater convenience than they do with the car. There are many things that city governments do to encourage more use of mass transit facilities, but they have had limited success. Raising parking fees, reducing the number of parking lots, partial subsidizing of bus and train costs, and supplying fleets of minibuses are some methods. Minibuses and van pooling provide the kind of door-to-door convenience that attracts passengers and discourages the use of the automobile.)



SHUT DOWN BY TIN LIZZIE

OBJECTIVES

This lesson acquaints students with some of the changes the automobile brought to the American small town. It asks them to think about changes -- in the ways people live together and in the quality of life that is often affected by rapid change.

Students should be able to:

1. Contrast the "good old days" with the pleasures of living today, now that we have the automobile and all the other oil and natural gas products.
2. Gain increasing competency in conducting an interview.

INTRODUCING THE LESSON

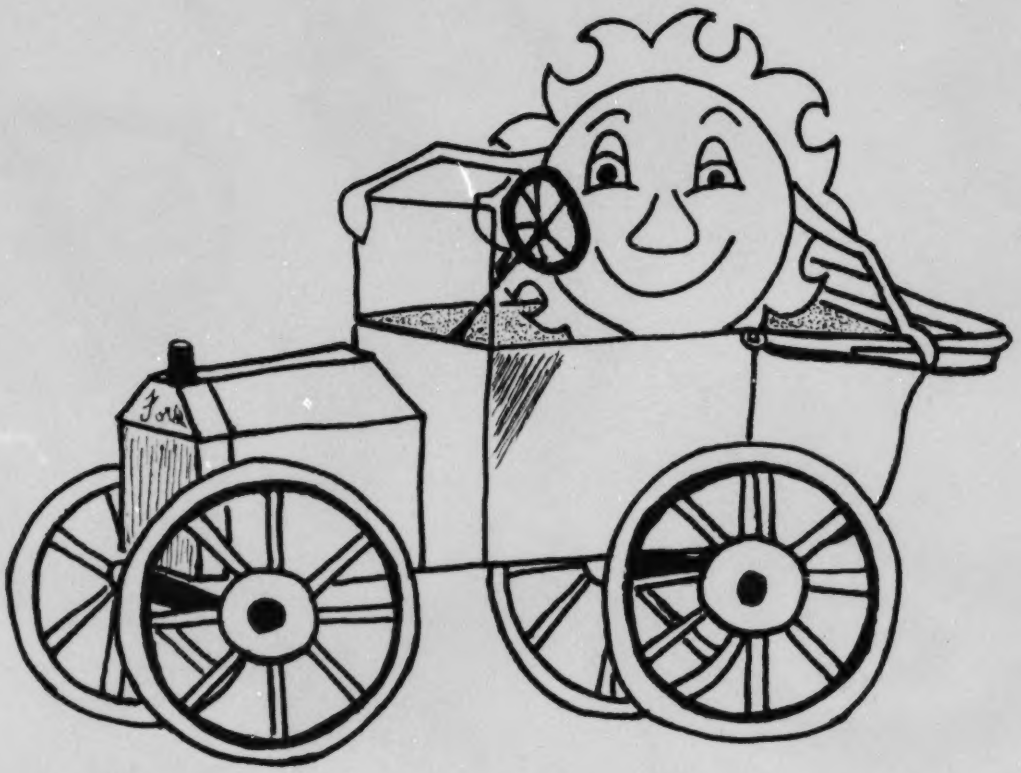
Have the students turn at once to the reading. After they have read it silently, ask the class to answer the questions that follow the reading. Use their responses to discuss the advantages and disadvantages of living in a small town. You may also wish to introduce a discussion of the effects of change. Do you think life has become less satisfying as it has become more complex? How did the coming of Tin Lizzie make life more enjoyable and, at the same time, less enjoyable?

DEVELOPING THE LESSON

Distribute the interview inventories, and have students interview someone who is old enough to remember what life was like thirty or forty years ago. At a later time, have students read their interviews in the class setting and summarize their findings.

SHUT DOWN BY TIN LIZZIE

Have students begin a study of history of their own neighborhood, visit the historic sites, study old maps, talk to the old people, and collect some of the things people used. In such an activity, you may help your students understand that such a way of learning is a way of sharing rich experiences that nourish each generation.



SHUT DOWN BY TIN LIZZIE

by Donald R. Harvey

Today, the countryside of the mid-western states is dotted with many once-thriving small towns, now little more than reminders of the vital role they formerly played in rural America. The advent of the automobile doomed them to the same fate as the mining town of the Old West when the ore ran out.

Prior to 1920, the horse-drawn vehicle and the railroad were the primary means of transportation. Most small towns were located from five to ten miles apart, usually along a railroad. They provided an essential initial stage in the flow of agricultural products to the markets of the large cities. Alongside the railroad tracks were usually a mill, grain elevator, and stock pens where farmers could market their cash crops and livestock.

A typical such town in Missouri had a population of slightly less than 500 in 1920. It was a lively, thriving trade center for people living within a radius of approximately five miles. It had two banks, two drugstores, six grocery and general merchandise stores, a furniture store, an undertaking parlor, a lumberyard, a livery stable, a blacksmith shop, a garage, three churches, and a hotel, in addition to the rail-side facilities mentioned above.

It also had its own school system from first grade through high school. No transportation was provided for students. Those living beyond reasonable walking distance rode horses before the car became commonplace. Students from outside the school district (approximately two miles square) paid a monthly tuition. The town elected its own school board, voted, and collected taxes.

SHUT DOWN BY TIN LIZZIE

The average family living in a small town was land-locked. Its only means of travel to another point was by the railroad. It had no need for horses for work purposes and would not think of going to the expense of maintaining them for an occasional Sunday afternoon ride in the country. Adult residents of the small towns were work-oriented. Vacation trips and leisure were terms with which they were relatively unacquainted. The workweek consisted of six very long days, and Sunday was needed to rest up for Monday. Consequently, there was practically no opportunity for leisure as we know it.

Between 1910 and 1920, the manufacture of automobiles underwent enormous growth. Previously, the automobile had been largely a novelty -- a sort of plaything for the well-to-do. A number of things began happening almost simultaneously. Many people got into the business of today -- like Ford, Dodge, Chevrolet, Buick, Oldsmobile, and Cadillac. Competition, plus the success of Henry Ford in producing a low-cost, practical car (the Model T), placed automobile ownership within reach of the average family, leading to a dramatic change in American life.

Ford developed a simple design and the ability to mass-produce it at low cost. In addition, a simple financing system was adopted on the monthly installment plan.

The people responded with enthusiasm, and soon, almost every family owned an automobile of some make or description. The availability of a car quickly modified old habits and attitudes. What was previously impossible or impractical, suddenly, became both possible and practical. The automobile made one-day recreational trips for town residents possible and provided the flexibility of going to the county seat or some other larger town or city without being dependent upon rigid rail schedules. In many instances, the round trip, between two towns only ten miles apart, could not be made by train without an overnight stop. Suddenly, such a trip could be made in less than one hour each way.

SHUT DOWN BY TIN LIZZIE

There was one drawback. The roads were designed for horse-drawn vehicles. They were dirt, or better stated, were mud when it rained. Anyone planning a trip by car, made it contingent upon fair weather. In summer, this might mean postponement of a needed trip for a day or longer, but in winter and spring, it was another matter. Sometimes, roads were impassable for automobiles for weeks. It was still the world of the horse.

The clamor for road improvement was great, and state legislatures responded. The 1920's saw tremendous road-building effort. All-weather roads were the objective. First, they were coated with gravel. It was the quickest and least expensive, but concrete and asphalt soon followed.

The combination of the car and the all-weather road meant death to the small town. The need simply ceased to exist. The farmer could go a dozen miles by car much easier and quicker than five miles by horse and wagon. So could the townspeople. The larger towns offered more services and more activity.

Today, the town mentioned above is a ghost. Its once active business section has been reduced to one gasoline service station and a small grocery store. People still live in the houses that remain, but they are employed elsewhere. There is no longer a high school, for the automobile made possible the school bus. The bus, combined with the highways, brought consolidation of school districts. But more than schools have been consolidated. Markets, churches, community boundaries, social and recreational activities have all been affected. Just as an old washboard serves as testimony to the existence of a day before the electric washing machine, many small mid-western towns stand as eroding monuments to the era before the automobile.

SHUT DOWN BY TIN LIZZIE

STUDENT QUESTIONS

1. Henry Ford did not make the first automobile. What was the important first that he did do?

2. How did the Modet T change the kinds of entertainment people once enjoyed in small towns?

3. How did school change with advent of better cars and roads?

4. What advantages did larger towns offer over small villages and towns?

5. How did the automobile have advantages over train travel?

6. How did the automobile make more leisure time available?

7. It has been said that the automobile made people less dependent on each other. How would you explain this statement?

SHUT DOWN BY TIN LIZZIE

STUDENT QUESTIONS - ANSWER KEY

1. Henry Ford did not make the first automobile. What was the important first that he did do?

   (Henry Ford introduced Americans to the first low-priced, mass-produced cars.)

2. How did the Model T change the kinds of entertainment people once enjoyed in small towns?

   (Entertainment and recreation changed from the at-home, with-our-neighbors kind to wider ranging ones found in the larger towns.)

3. How did school change with the advent of better cars and roads?

   (Better roads and school buses introduced the comprehensive high school -- larger, more remote, with consolidated and less personal and independent school districts.)

4. What advantages did larger towns offer over small villages and towns?

   (Larger towns offered more services and more activities.)

5. How did the automobile have advantages over train travel?

   (The automobile offered more flexibility than trains. People using trains had to depend on rigid schedules and could count on a round trip taking more time because of rail routes. An overnight stay would therefore make a train journey more expensive than going by car.)

6. How did the automobile make more leisure time available?

   (Since the car made one-day trips possible and practical, more recreational trips could be arranged on Saturdays and Sundays. Once land-locked and dependent on the railroads, people became more flexible and less work-oriented with the automobile.)

7. It has been said that the automobile made people less dependent on each other. How would you explain this statement?

   (People could get in their cars, and as the saying goes, take off by themselves if no one else could come along. They no longer depended on services offered by trainmen, local shopkeepers, or members of their family for services and leisure-time activities.)

"THE GOOD OLD DAYS" -- OR WERE THEY?

Interview someone who is old enough to remember what life was like before the days of high technology, plastic, electronic games, television, and multiple gadgets. Ask this person the questions on these pages and others you may think of.

1. How did you heat your home?_____

_____

What kind of fuel did you use for heating and cooking?_____

_____

2. What did a workweek consist of in days and hours?_____

_____

3. How did you buy the necessary things: food, clothing, medicines, etc.?_____

_____

4. How did you get to work?_____

_____

To school?_____

Did your family own a car?_____

If so, do you remember the name of your family's first car?_____

_____

How much did it cost?_____

5. What kinds of entertainment did you enjoy?_____

_____

6. What was clothing made of?_____

How was it kept clean?_____

What kind of a laundry machine did you have?_____

How did you heat the water?_____

What were soaps like?_____

How did you dry clothes?_____

7. What were the eating facilities like in your school?____

_____

The bathrooms?_____

What did you have for school supplies?_____

8. Today, plastics are used so much in packaging. What did you use?_____

Was milk delivered?_____

How did you keep food from spoiling?_____

9. What was your home lighted by?_____

10. Did your family go on vacation?_____

If so, how did they get there?_____

11. What were roads like then?_____

_____

12. What happened to your old schoolhouse?_____

_____

How did your school change with the coming of school buses?_____

_____

13. How do you think the car changed things in your town (or city)?_____

_____

THE CITY OF WINDSHIELDS

OBJECTIVES

Los Angeles, California is one of our largest metropolitan areas and, like others, it is faced with many problems. We will focus our attention on some of the effects of the automobile on the design of the city and on the everday lives of the people.

Students should be able to:

1. Describe how the automobile has affected the environment of Los Angeles.
2. List the positive and negative aspects of the automobile on the environment and on the citizen's sense of time and space.
3. Explain the term photochemical smog and describe its effects on people and things.

INTRODUCING THE LESSON

One very good way to arouse intelligent interest in this lesson is to invite a specialist in city transportation to talk to the class on traffic and traffic management. Among the many people possibly available are police officers, a staff person from the mayor's office, a town planner, a sociologist, or a staff member from the local transportation office. The interest in this lesson is not to make everyone a traffic expert, but to foster good attitudes toward thinking about alternatives to the automobile.

DEVELOPING THE LESSON

Have students turn to the reading and answer the questions. You may wish to have one member of the class read the article aloud, and to have students respond orally to the set of questions, and in this way, to promote wider discussion of the issues.

THE CITY OF WINDSHIELDS

The following is an excerpt taken from The Limits of the City, by Murray Bookchin, Harper and Row Publishers, Inc., New York, 1974, pp. 68-71. The article shows the effect of the automobile on Los Angeles, California.

"...Los Angeles is normally seen through a windshield. Because of the city's enormous size, the car is the essential and unavoidable means of transportation: about 95 percent of travel in the metropolitan area is done by car. It is estimated that there is one automobile for every 2.5 people, compared with 3.5 in Detroit, the automotive capital of the United States. And these cars are in daily use, bringing wage earners to their jobs, children to schools, and shoppers to local stores. Roughly, 60 percent of the central city's land is devoted to parking lots, roads, and garages, in addition to the considerable area that is occupied by its multitude of gasoline and service stations.

It is not enough to say that Los Angeles is an overgrown suburb made possible by motor vehicles and freeways, for this suggests certain natural amenities -- trees, shrubs, and open fields -- that are a secondary value to the southern California metropolis. In Los Angeles, the automobile is not only a means of transportation, but a state of mind that shapes the citizen's sensibility toward his environment, life-style, and concept of space and time. So committed is the .... Angelino to the motor vehicle, that a proposal to build a mass transit system for the city was resoundingly defeated in a popular referendum. To travel fifty or sixty miles to a choice restaurant -- possibly, driving two hours in order to while away one -- is often no more debatable an issue than to travel

a smaller distance to and from work daily ....Not surprisingly, one finds that Los Angeles city authorities arrayed plastic "vegetation" along a stretch of freeway to replace shrubs that were perishing from air pollution. The reason for this inspired experiment was not lower costs; indeed, it would have been more expensive to vacuum-clean the synthetic product than periodically restore the real vegetation. Hard as it may be to believe, the civic authorities thought that the plastic "plants" were more "attractive" than real ones.

Gasoline exhausts from millions of motor vehicles produce air pollution problems in Los Angeles -- a city that is notoriously burdened by temperature inversions and photochemical smog.... The only administrative institution around which Los Angeles coheres (listens to) is its district-wide Air Pollution Control Board -- an agency formed to deal with a potentially lethal environment... This board has enormous powers. Its three-stage "smog alert" system stipulates that it can bring all traffic, industrial activity, and even power generation to a virtual halt. Presumably, if the final alert -- a "general emergency" -- failed to cope with a pollution crisis, Angelinos might use their motor vehicles to flee to the mountains..."

VOCABULARY -- Angelino -- a person living in Los Angeles.
Photochemical smog -- a mixture of smoke and fog caused by modern automobile exhaust.

THE CITY OF WINDSHIELDS

STUDENT QUESTIONS

1. How can you explain the statement: Los Angeles is normally seen through a windshield?

2. When and how do the people of Los Angeles use their automobiles?

3. How has the automobile changed the appearance of Los Angeles?

4. Many large metropolitan areas have mass transit systems. Why has Los Angeles refused so far to construct one?

5. How has the automobile affected the Los Angelino's sense of time and space?

6. What is a major problem facing all citizens of Los Angeles because of the automobile?

7. What can the city do to solve this problem?

8. How has the city attempted to control smog?

9. Pretend you are a citizen of the city of Los Angeles or any large city. Write a letter to your mayor or city manager stating the problems caused by the automobile. State how you would solve the problem. What alternate transportations would you suggest? How would you encourage people to adopt your ideas?

THE CITY OF WINDSHIELDS

STUDENT QUESTIONS - ANSWER SHEET

1. How can you explain the statement: Los Angeles is normally seen through a windshield?

   (Most people in Los Angeles rely on the single-passenger car. Students may find it interesting to know that for every baby born each year, two cars are made.)

2. When and how do the people of Los Angeles use their automobiles?

   (People use their cars for getting to and from work, taking children to school, going shopping, eating out, and finding places of recreation -- to mention only a few.)

3. How has the automobile changed the appearance of Los Angeles?

   (Los Angeles, perhaps more than any other American city, is a product of the automobile. Approximately 60% of the land area is used for parking lots, roads, gasoline service stations, and repair garages. Even artificial plants decorate the highways, indicating that the pollutants are very great.)

4. Many large metropolitan areas have mass transit systems. Why has Los Angeles refused so far to construct one?

   (So far Angelinos have resisted efforts of large-scale mass transit systems. One reason may be their deeply-ingrained love for the independence of their automobiles.)

5. How has the automobile affected the Los Angelino's sense of time and space?

   (The article certainly suggests that convenience rather than a better sense of time and space takes priority in the minds of most Angelinos.)

6. What is a major problem facing all citizen of Los Angeles because of the automobile?

   (Photochemical smog is a major problem. This soupy, eye-watering smog is caused by a mixture of the chemicals that come from the car's exhaust pipes with sunlight. It is painful and irritating to the eyes and lungs, but no deaths have resulted from this kind of smog. However, automobile smog kills trees and plants. The automobile is also responsible for two other pollutants, carbon monoxide and lead. Carbon monoxide can be deadly. Such closed-in spaces, such as tunnels, can cause deadly buildups of carbon monoxide very quickly. Lead is released by burning

leaded gasoline. Since it accumulates in the body, we must watch out for the long-range effects of lead exposure.)

7. What can the city do to solve this problem?

   (Student answers will vary. Certainly, some of the discussion should involve the possibilities of mass transit systems.)

8. How has the city attempted to control smog?

   (Los Angeles has established an area-wide Air Pollution Control Board which has wide powers to curtail polluting devices. If fully implemented, the policies could bring air pollution under control.)

9. Pretend you are a citizen of the city of Los Angeles or any large city. Write a letter to your mayor or city manager stating the problems caused by the automobile. State how you would solve the problem. What alternate transportations would you suggest? How would you encourage people to adopt your ideas?

   (Student letters should consist of more than a list of complaints. Use this activity to help students develop better skills in writing exposition.)

THE CAR ON TRIAL

OBJECTIVES

America, in the 1980's, is a mixture of problems and promise. This activity asks students to investigate the problems caused by the car in America. It also asks them to weigh the promise of the car against the problems it has produced.

Students should be able to:

1. Consider some of the automobile's positive and negative influences on our lives.
2. Role-play a trial to determine the guilt of innocence of the car under the charge: THE CAR HAS DONE PERMANENT INJURY TO HUMANITY.

INTRODUCING THE LESSON

Ask students to think of important technological inventions directly touching our lives, which were invented in the last 50 years. Ask a student to lead a recall session and to list on the board all those inventions suggested by the class. Next, ask each student to list all the ways he or she has used the automobile (including trucks, buses, vans, etc.) during the last 24 hours. How has the car revolutionized our day-to-day living? What are the advantages of the car? What are the disadvantages? What has been the effect of the car on energy resources, particularly oil (and gasoline), in the last 50 years?

THE CAR ON TRIAL

DEVELOPING THE LESSON

Have students make notes in their notebooks, adding the following questions for discussion to the previous day's.

1. Can a person turn his or her back on the car? Can we go back to another way of life?
2. Are there groups in America who do this? What transportation systems do the Amish use? How would you interpret this cartoon?

"What's an energy crisis, Pa?"

3. How do other groups, such as individuals in a commune get around without using a car? What are the advantages of riding a bike? Disadvantages?
4. What effect has the automobile had on our educational system? How have course offerings been affected? Time in school -- how has this been affected? How has the automobile affected the design of school buildings? How has it affected where the school itself is located?
5. What effect has the automobile had on places where we shop?
6. How has it influenced where we live?

THE CAR ON TRIAL

7. How has the automobile influenced our use of leisure time?

8. How has it influenced the manner in which we buy things to eat?

SPECIAL ACTIVITY

Conduct a brainstorming session about trials. What is the purpose of a trial? What does a jury do? What can you remember about seeing trials on television?

1. Explain to the class that they are going to put the automobile on trial; that it has been accused of doing permanent injury to humanity. During the next three days, the class will determine the guilt or innocence of the charge. Ask for student volunteers for the following roles:

PROSECUTION GROUP	DEFENSE GROUP	JUDICIAL GROUP
Prosecutors (2)	Defense Attorneys (2)	Judge (or Court Clerk) (1)
Prosecuting Witnesses & Consultants (4-8 Students)	Defense Witnesses & Consultants (4-8 Students)	Bailiff (1)
		Court Reporter (1)

2. When students have assumed their roles, have them divide into the three preparation groups and begin their preparation activities.

   A. The prosecution group might consider:

      (1) List the ways the automobile has been harmful to people. For example, polluted air and water (at the factory site), drain on fossil fuel resources, particularly oil, and urban sprawl. Students might find it useful to organize the problems connected with the automobile into the following headings: Traffic Snarls, Growth of Suburbs, High Use of Gasoline and Oil, Visual Pollution (including proliferation of roadside signs), Highway Deaths, Safety on Urban Streets, Air Pollution, and Accelerated Changes in the Lives of People --- not all to the good.

A. (2) Prepare witnesses to testify to the existence of specific abuses. For example, use data and charts, tables, and graphs. These are readily available in most school social studies texts, in library books, and vertical files. An additional good source is the Energy-Environment Source Book by John M. Fowler (Washington: National Science Teachers Association) 1975.

B. The preparation activities of the defense group might include:

(1) List of ways in which the automobile has benefited people. For example, it has created jobs in manufacturing automobiles and improved work that requires a substantial amount of traveling, such as sales. Shorter workweek? Consider the automobile's importance in the nation's economy. Consider the labor-saving qualities of the automobile in hauling and transporting things. Have students anticipate the categories and arguments the prosecution will present and prepare a defense against these agruments.

(2) Prepare witnesses to testify on behalf of the automobile. For example, "Before the automobile came along, I had to spend hours traveling to my job on the train. Even getting to the station and back each day required so much extra time that I could not help my patients as often or as much. Now I can see many more patients each day in my office, and I can get to hospitals more quickly. I can now help more people than before." Have students develop specific roles similar to this one.

C. The preparation activities for the judicial group might include:

Have the group go to another classroom, or find a space out of earshot of the defense and prosecution groups so that they will not be influenced by these preparations. (Perhaps you could invite another class to serve as jurors or as an audience in the courtroom, if your class is small or if you would like to use thoroughly unbiased judgments.) The bailiff and the court reporter should go to the library and research the duties of the positions they will fill. The judge should research his job, either in the library, or consult the teacher. The judge, bailiff, and court reporter should arrange the furniture to resemble a courtroom. Borrow a flag from the multipurpose room for some courtroom ambiance, and perhaps ask the office staff or the principal to lend his heavier, leather furniture.

3. Allow at least one class period for the trial. You may wish to videotape the trial for other classes to see at a later time, if your school has such equipment available. Courtroom procedure you may want to follow should include the following: (also see Outline of Steps in a Jury Trial, page 42.)

A. Before the trial begins, the jurors swear to decide the facts fairly. Court clerk will give the oath to the jurors. Below is the oath taken by the witnesses.

JURORS' OATH

You do solemnly promise or declare that you shall well and truly try the issues joined between (plantiff) and (defendant) and a true verdict give according to the evidence.

B. The judge calls the court to order and states the charge against the automobile. (You may want to borrow a choir robe for the judge or use a graduation gown.)

C. The judge and the jury hear testimony of witnesses for both sides.

WITNESSES' OATH
Do you swear to tell the truth, the whole truth, and nothing but the truth?
Response: I do.

Note to the Teacher: You might like to discuss why the words: "the whole truth and nothing but the truth," are added. Why not ask: Do you swear to tell the truth? What is the difference between these phrases?

The prosecution will present its side first. After the defense has been heard, a cross-examination period is held. Witnesses previously sworn can be recalled and their testimony rebutted.

The attorneys for both sides sum up their agruments before the jury starts its deliberation.

4. The judges charges the jury, explaining the possible verdicts it could deliver in a civil case. (You may decide that the customary unanimous vote is not necessary for a verdict of innocent or guilty.)

OUTLINE OF STEPS IN A JURY TRIAL

A. Selection of Jury
   1. Voir Dire
   2. Peremptory Challenge

B. Opening Statements
   1. By Plaintiff's Counsel
   2. By Defendant's Counsel

C. Presentation of Plaintiff's Case
   1. Examination of Witnesses
      a. Direct Examination
      b. Cross-Examination
      c. Redirect Examination
      d. Recross-Examination
   2. Introduction and Admission of Exhibits

D. Presentation of Defendant's Case
   1. Examination of Witnesses
      a. Direct Examination
      b. Cross-Examination
      c. Redirect Examination
      d. Recross-Examination
   2. Introduction and Admission of Exhibits

E. Presentation of Rebuttal

F. Instructions by the Court

G. Final Arguments
   1. Plaintiff's Closing Arguments
   2. Defendant's Arguments
   3. Plaintiff's Rebuttal Arguments

H. Deliberation of Jury

I. Receipt of Verdict by Court

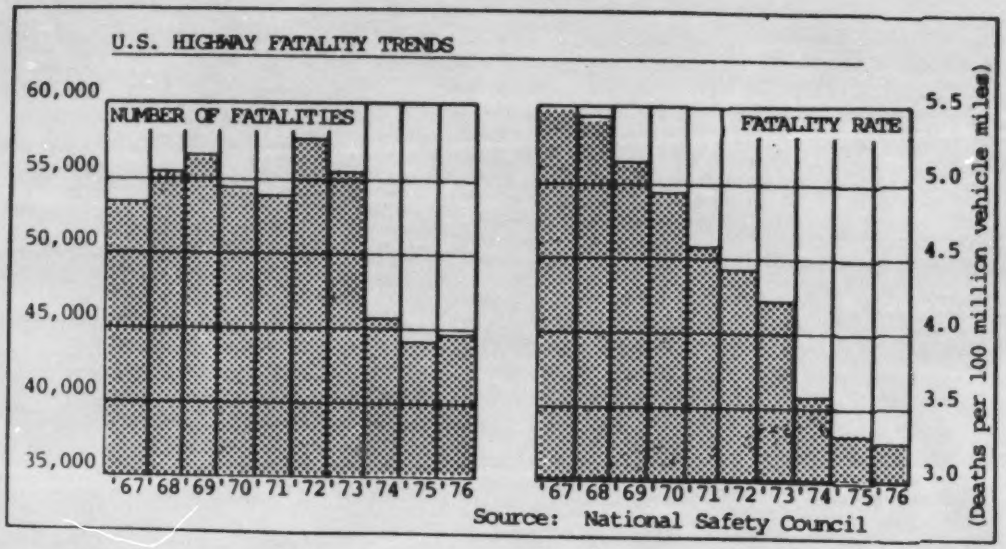
THE CAR ON TRIAL

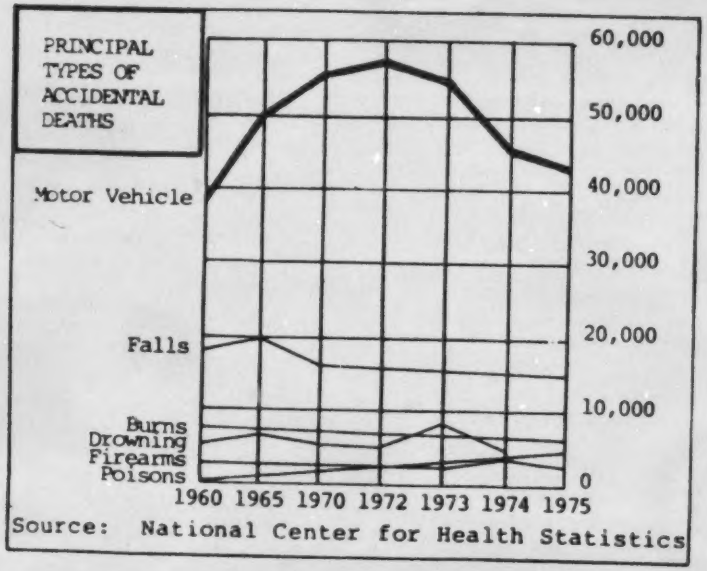
Duties of Clerk During Trial

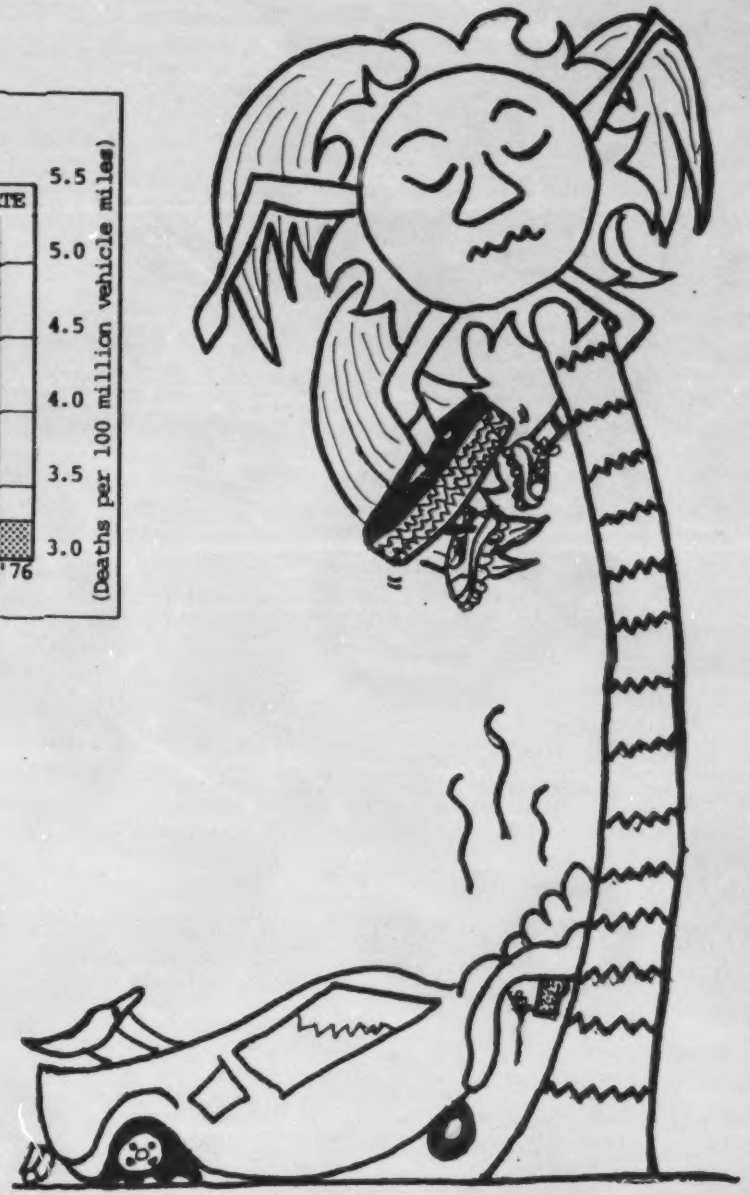
A. Call Case
B. Selection of Jury
   1. Voir Dire Oath
   2. Peremptory Challenge
   3. Calling of the Jurors
   4. Swear in the Jury
C. Swear in Witnesses and Mark Exhibits
D. Swear in Bailiff, Prior to the Jury Leaving to Deliberate
E. Receive and Record the Verdict

This page contains a sampling of the kinds of data and graphic presentation students might use to present as evidence before the jury. For example,

Headlines	1975 AUTO CRASH TOLL: 4 MILLION HURT AT COST OF $37 BILLION
Graphs	U.S. Highway Fatality Trends Principal Types of Accidental Deaths (Highway and Motor Vehicle Lead All the Others)
Tables	Auto Casualty Rates
Pictures	Show Car Collision
Combination For Optimum Persuasive Devices	Car Collision Graphs superimposed to show maximum effect of gruesome data (See sample)


U.S. HIGHWAY FATALITY TRENDS
NUMBER OF FATALITIES
60,000
55,000
50,000
45,000
40,000
35,000
'67 '68 '69 '70 '71 '72 '73 '74 '75 '76
FATALITY RATE
5.5
5.0
4.5
4.0
3.5
3.0
(Deaths per 100 million vehicle miles)
'67 '68 '69 '70 '71 '72 '73 '74 '75 '76
Source: National Safety Council


PRINCIPAL TYPES OF ACCIDENTAL DEATHS
Motor Vehicle
Falls
Burns
Drowning
Firearms
Poisons
60,000
50,000
40,000
30,000
20,000
10,000
0
1960 1965 1970 1972 1973 1974 1975
Source: National Center for Health Statistics



AUTO CASUALTY RATES

Rate Per 100 Million Vehicle Kilometers

	Vehicles Per 1,000 Pop.	Injuries	Deaths
Australia (1974)	435	93	3.6
Belgium (1972)	255	290	8.5
Canada (1971)	409	144	4.2
Denmark (1972)	281	92	4.0
Finland (1973)	219	77	5.0
France (1974)	328	157	6.2
Great Britain (1974)	284	134	2.9
Iceland (1973)	297	128	2.6
Italy (1972)	247	143	5.9
Japan (1974)	244	185	3.0
Netherlands (1974)	278	101	3.9
New Zealand (1973)	416	147	5.0
Norway (1974)	261	71	4.0
U.S.A. (1973)	545	135	2.6
West Germany (1974)	301	162	5.8

SOURCE: International Road Federation

OBITUARY TO A "GAS GUZZLER"

OBJECTIVE

To discover the relationship between the energy supplies and automobile engine efficiency.

INTRODUCING THE LESSON

Read this to your class: A television news story stated that "An association of owners of Rolls-Royce automobiles is lobbying for special consideration for their gasoline needs in the event of a gasoline shortage. Their reason: they are unique, and their 5 mile-per-gallon 'gas guzzlers' are an important element of the good life of America and should be maintanined." The owners also expressed their willingness to pay a penalty tax of $500 to $1000 to offset their high use of energy.

DEVELOPING THE LESSON

1. Ask: "Do you think the large, luxury car owners have a valid agrument?'
2. Discuss the pros and cons of their case.
3. Ask: "Do you believe a penalty of $500-$1000 would make up for their excessive use of gasoline?" (Their cars cost up to $75,000.)
4. Check with your local big-car dealers to determine any changes in their automobile since the oil crisis of 1973 in:
   a. weight of automobiles
   b. gasoline efficiency in miles-per-gallon
   c. sales volume
   d. advertising (efficiency vs. luxury)

5. Survey small-car dealers to determine any change in the numbers of big-car owners who have traded in their "gas guzzlers" for a small automobile.
6. Investigate the availability of diesel engine automobiles.
7. Write an obituary to a "gas guzzler".

EXTENDING THE LESSON

1. Design an epitaph to a "gas guzzler".
2. Ask: "What will take the place of the large luxury car in the dreams of the people?"
3. Write a poem on the new dream.
4. Write a class skit showing the last owner of a "gas guzzler" trying to buy gasoline.
5. Have the class observe a moment of silence for the last "gas guzzler".
6. Compare the worst "gas guzzling" automobile with a yacht or private airplane.
7. Ask: "Is a compact car 'saving gas' driving down a highway as its bumper sticker says?"
8. Play a game filling in the blank with one or two word endings. Student with the most words wins. (For example: An automobile is saving energy when it is _____ parked, tuned-up, coasting, turned-off, etc.)

WHERE HAS ALL THE FUEL GONE?

OBJECTIVE

To discover the relationship between energy and work.

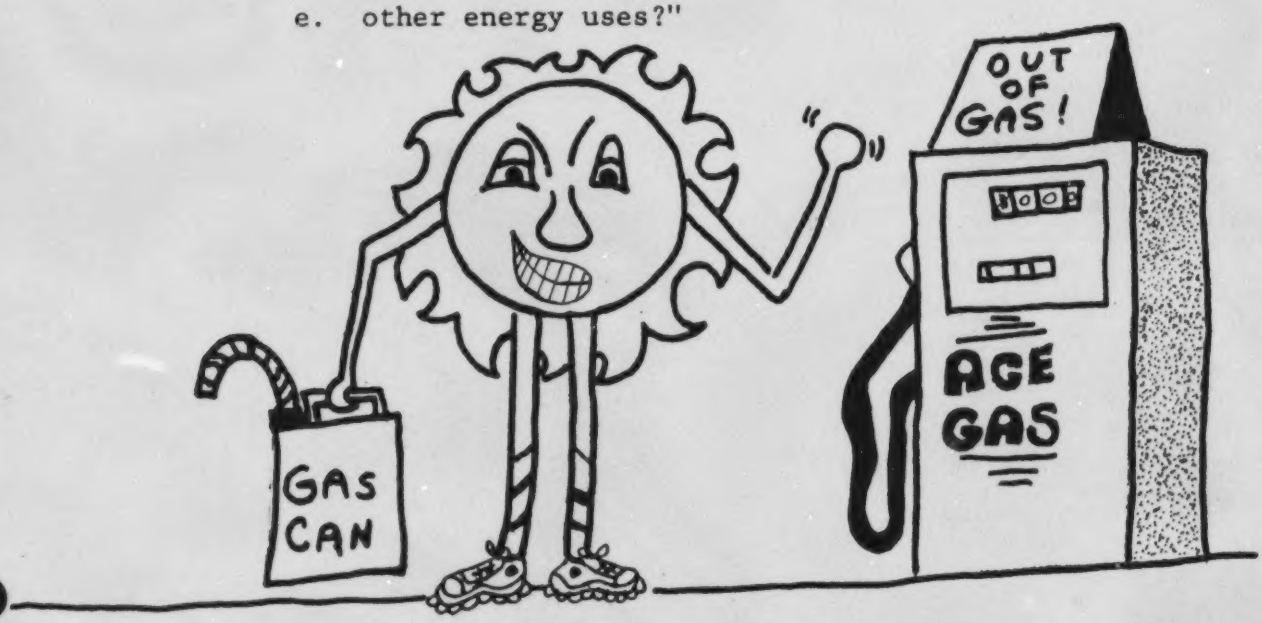
INTRODUCING THE LESSON

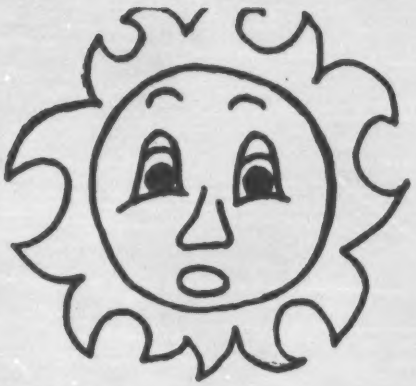
1. Ask: "How many of your parents have had difficulty getting gasoline for their cars?"
2. Make a list of the class members and the occasions when their parents were unable to get gasoline.

DEVELOPING THE LESSON

1. Have the students keep a record for a week of all the gasoline stations that have lines of cars; closed days; "out-of-gas" signs, etc.
2. Do a similar survey to locate closed stations and the brand name of the gasoline they formerly sold.
3. Ask: "What kinds of stations seem to be most affected by the gasoline shortages?"
4. When your parents get gasoline, survey the station owners to find out:
   a. where does their gasoline come from?
   b. how much do they get each month? (their allocation)
   c. who decides this amount?
   d. how does their allocation compare with the year before?
   e. do they own their station or operate it for an oil company?
   f. would they favor some kind of rationing plan?

5. Draw a picture of you and your parents waiting in a line to get gasoline for your car.
6. Ask: "How do the values of people affect their behavior in the gasoline station line?" (Are they patient, rude, greedy, thankful to be getting gasoline, other?)
7. Draw a picture which would illustrate your lifestyle if gasoline use was limited to getting to work and shopping.
8. Discuss your picture and compare it with those of other members of the class.
9. Ask: "Were your pictures realistic?"
10. Ask: "How would your new lifestyle affect you and your community in terms of:
    a. community activities?"
    b. shopping?"
    c. recreation?"
    d. out-of-community activities?"
    e. other energy uses?"





"WHO - ME?"

OBJECTIVE

To discover that each individual has a responsibility to conserve energy.

INTRODUCING THE LESSON

1. Ask: "Are you part of the energy problem?"
2. Ask: "What have you done today to conserve our scarce energy supplies?"
3. Make a list of the things students did to conserve energy during the past week.

DEVELOPING THE LESSON

1. Ask the students who feel that they are not part of the energy problem to defend their position. Have a recorder keep a record of the discussion.
2. Ask the students to record for one week:
   a. number of times they opened the refrigerator
   b. asked their parents to drive them somewhere
   c. rode a bike instead of asking for a ride in a car
   d. drank a cold drink
   e. used ice cubes
   f. took a hot shower
   g. sat in an over-cooled room
   h. watched television
   i. add another item.
3. Discuss how the energy shortage has changed the lives of members of the class and their families.
4. Investigate the effects on the school, the community, the state, and the nation.

POPULATION AND ENERGY SUPPLY

OBJECTIVE

To discover the relationship between energy supply and numbers of people.

INTRODUCING THE LESSON

1. Take the class outside to a quiet area of the school grounds. With a ball of string, lay out a circle about 20 feet in diameter. Then use more string to divide the circle into eight smaller sections of different sizes. The circle now represents the earth divided into several nations of different sizes.
2. Place half of the students in the countries to represent the population. Be sure to have at least one small country with three people and one large country with only one.
3. Let the rest of the class stand around the circle.
4. Show the class a bag of dried beans, preferably small and dark so they are harder to see. Say: "These beans represent all the fossil fuel in the world".
5. Scatter the beans (modules of energy) unevenly around the "earth". Be sure to put only a few beans in the smallest country and many beans in the largest country.

DEVELOPING THE LESSON

1. To start the game, ask each person to pick up one energy module. (If you want the game to go faster, pick up two.)
2. Pick up one more energy module.

3. Add one person to each country to represent an increase in population.
4. Pick up another energy module.
5. Continue the search for energy modules, with an occasional addition to the population, until the whole class is in the circle.
6. When a population in a country cannot find any more energy modules, they must leave the circle.
7. Continue the game until only a few countries have energy modules left, or interest lags.
8. Ask: "Which countries end up with energy?"
9. Ask the students to compare the game with the world situation.
10. Ask the students to compare the countries in the game with real nations. (Is the small nation like Japan?)
11. Discuss how the real world differs from the game. (In the real world, many resources are involved, not just oil, so an energy-poor nation may have another resource to trade for energy.)
12. Discuss the actions of the students in the game:
    a. What did they observe?
    b. Did people get anxious, greedy, selfish?
    c. Did people reach over borders?
    d. Did people share?
13. Ask: "How do you account for these behaviors?"
14. Investigate the following nations to determine: size; population; energy reserves; major resources to trade: Venezuela, Canada, U.S.A., Saudi Arabia, Iran, Nigeria, Japan, Mexico.
15. Discuss the effects of increasing world population and increasing demand for limited energy supplies. Consider:
    a. economic effects
    b. political effects
    c. effect on standard of living.

SOLAR ENERGY RESEARCH

OBJECTIVES

1. Find and list the available sources of information regarding solar energy.
2. See what has been done in the area of solar energy research and development.
3. Develop research skill.

INTRODUCING THE LESSON

With the need for alternate energy sources becoming more noticeable and desirable every day, an obvious source is the sun. What needs do we have as far as energy is concerned? How can solar energy fit these needs? What research and development has been done in the area of solar energy? Most of the recent work is too new to be found in textbooks but is instead found in various magazine articles. In this activity you will be using your library to find some of this information.

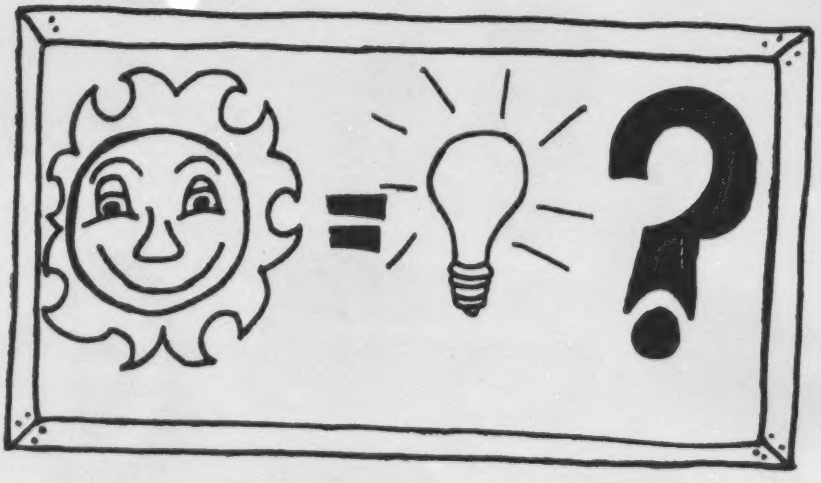
The information you collect will serve as a reference to you, your class and your teacher in studying solar energy. It will also serve as a bibliography for your own research of solar energy. The sources which you could list, yet not find in your library, may be available in other libraries such as county, regional or even state libraries.

DEVELOPING THE LESSON

1. From the Reader's Guide or other library references, find and list the articles or books concerning the energy crisis, sources of energy, and solar energy. Use one or more of the data sheets to record this information.

SOLAR ENERGY RESEARCH

2. Using your list, find as many of these articles as possible. Read five of them and note the important parts on a separate sheet of paper. While doing this keep in mind that the material could be used for general discussion by all the class. If a source is not available, also note this on your data sheet.
3. Which magazine or reference do you think contains the best article on solar energy?
4. Were there any magazines or references that were too difficult for you to read?
5. Based on your research, how important is solar energy as a future energy source?
6. Write a research paper on some aspect of solar energy?
7. Try to obtain additional information on solar energy from such sources as the government, utilities, industries, or businesses.
8. Try to obtain some of the sources not available in your library.



SOLAR ENERGY RESEARCH

LIBRARY RESOURCE LIST DATA SHEET

TITLE OF THE ARTICLE OR REFERENCE	AUTHOR IF INDICATED	MAGAZINE OR OTHER REFERENCES	VOLUME/ ISSUE	DATE	PAGES	WHERE AVAILABLE

ENERGY ADS AND YOU

OBJECTIVE

To discover the relationship between energy shortage and advertisements for business products.

INTRODUCING THE LESSON

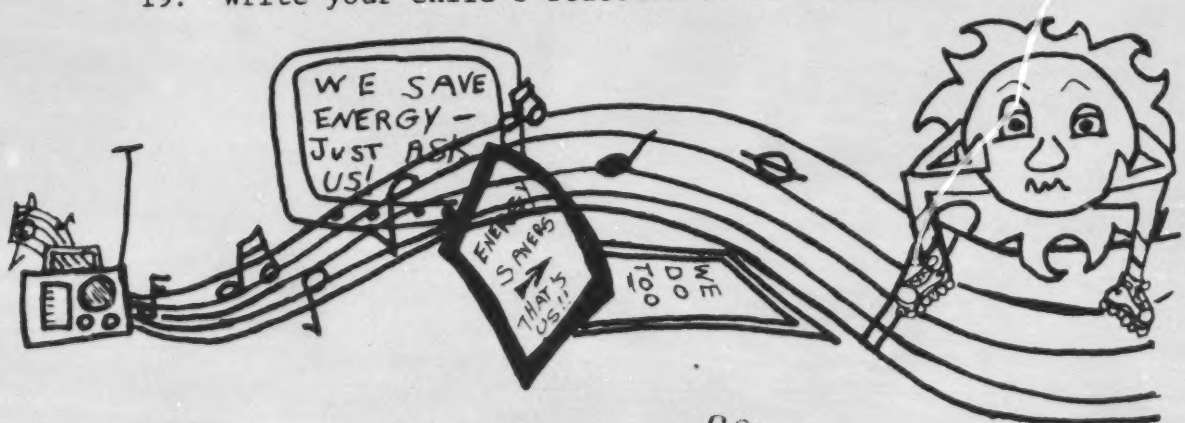
1. Collect energy industry advertisements from newspapers and magazines and discuss their messages to the public.
2. Classify the advertising into categories. (Price rise justification; "what a good job of conservation we're doing"; cost of regulation; "survival" ads arguing against divestiture of competing energy sources, etc.)

DEVELOPING THE LESSON

1. Discuss the validity of each of the categories of adveristements you collected.
2. Ask: "Are the arguments of the energy companies persuasive?"
3. Look for ads that "turn you off"; "turn you on".
4. Discuss the reasons for the "turn off" or "turn on".
5. Collect ads from other businesses or industries that contain an energy message. (Low mileage cars, etc.)
6. Look for ads which indicate a change in approach because of the energy shortage. (Large cars emphasizing mileage and smaller size instead of luxury, etc.)

ENERGY ADS AND YOU

7. Ask: "Why would an electric power advertisement call for conservation and decreased use of electricity? (Power companies can no longer meet the unlimited demands of people for electricity.)
8. Create a "billboard" advertisement for your school which stresses conservation of electricity.
9. Design a cover for a new magazine to be called EN-ER-GEE.
10. Write an advertisement to appeal to new subscribers for your new magazine.
11. Design and produce a television commercial.
12. Write a radio commercial.
13. Write the first energy editorial for EN-ER-GEE.
14. Write a "letter to the editor" of EN-ER-GEE supporting or criticizing the first editorial.
15. Divide the class into several editorial boards which will suggest topics for inclusion in the magazine.
16. Design the magazine on the basis of their recommendations.
17. Write an article for EN-ER-GEE which describes to your future son or daughter the present energy situation and what you are doing about it.
18. Illustrate your article.
19. Write your child's reaction to the letter.



FLORIDA CLIMATE

OBJECTIVE

To discover the relationship between solar energy and the climates of the world.

INTRODUCING THE LESSON

1. Have the students collect advertisements which feature Florida's climate.
2. Make a bulletin board display of the advertisements.
3. Ask: "What can we learn about the attraction of Florida's climate on housing, tourism, fishing, and other industries that might wish to come to Florida?"

DEVELOPING THE LESSON

1. Investigate the reasons for Florida's warm climate. (Geographical location, amount of intensity of the sun, angle of the sun's rays, etc.).
2. Ask: "What does the term "tropical" mean?"
3. Compare the length of daylight and the average yearly temperature of your community with that of Chicago; Atlanta; Washington, DC; and Anchorage, Alaska.
4. Consider other factors which influence Florida's climate which are indirectly related to the radiant energy of the sun. (Gulf stream, warm waters of the Gulf of Mexico, summer showers.)

FLORIDA CLIMATE

5. Investigate the effects of Florida's warm, sunny climate on:
   a. population -- growing rapidly, older than average
   b. tourism -- a warm winter vacation here
   c. industry -- fishing, housing, agriculture (winter crops)
   d. wildlife -- winter home
   e. any other
6. Draw a picture of a tourist enjoying a Florida vacation.
7. Describe your picture, telling how the climate affects the activities shown in your picture.
8. Discuss the harmful effects of the Florida sunshine. (Sunburn, skin cancer, etc.)
9. Write a letter to a northern friend telling of the "wonderful climate" of your area of Florida.
10. Have the students design a billboard to be placed along northern highways telling people about Florida's climate and the life-styles of people.
11. Have the students design a billboard telling people why they <u>should</u> or <u>should not</u> come to Florida to live.

SOLAR ENERGY AND CLIMATES

OBJECTIVE

To discover the relationship between solar energy and the climates of the United States.

INTRODUCING THE LESSON

1. Have the students collect advertisements which feature Florida's climate.
2. Make a bulletin board display of the advertisements.
3. Ask: "What can we learn about the attraction of Florida's climate on housing, tourism, fishing, and other industries that might wish to come to Florida?"

DEVELOPING THE LESSON

1. Investigate the reasons for Florida's warm climate. (Geographical location, amount and intensity of the sun, angle of the sun's rays, etc.)
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   e. any other
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11. Have the students design billboards telling people why they <u>should</u> or <u>should not</u> come to Florida to live.

ENERGETIC LOCATIONS

OBJECTIVE

Discover the relationship between geographic location and the use of sunshine, tides, and wind to produce useable energy.

INTRODUCING THE LESSON

1. Prepare maps of the U.S. and/or the world showing population density, average hours of sunshine (National Geographic, March 1976), and average wind velocity (National Geographic, December 1975).
2. Gather tidal information of the fifteen coastal areas of the world which have 40 feet or more difference in tides. (Forty feet is needed to produce usable energy.)

DEVELOPING THE LESSON

1. Where are areas of the earth that have the highest average of sunshine?
2. What areas have the highest and most consistent wind velocity?
3. How much wind is needed to produce useable energy?
4. Are these energy producing areas near the world population centers?
5. Only the French and Russians have succeeded in developing tidal power plants. Ask: "Why do you think there has been so much controversy about building tidal power plants?" (Require a dam completely across a bay and very expensive.)

6. Investigate the construction of the French tidal power station in the LaRance estuary in Brittany, France which uses water from the English Channel.
7. Can direct energy from the sun be used in all areas of the U.S. or the world? Why or why not?
8. Can the energy of the wind be used in all areas of the U.S. or the world? Why or why not?
9. Can the energy of the tides be used to replace all other energy forms? Why or why not?

WIND POWER

OBJECTIVE

To understand the relationship between solar energy and moving air.

INTRODUCING THE LESSON

1. Complete the following sentence: "Wind is ....."
2. Write the students' words on the chalkboard as fast as you can, no matter how unlikely they may sound to you.
3. From this list of words develop a list of opposite words which can be used to describe moving air. (For example, hot-cold; good-bad; fickle-steady; reliable-unpredictable; gentle-violent; etc.)

DEVELOPING THE LESSON

1. Ask: "What do most of the words tell us about what wind is?" (Moving air)
2. Investigate the atmosphere around the earth as a giant heat machine (engine) moved by solar radiation. (The rays of the sun, stronger near the equator than in the polar regions, cause tropical air to warm and rise, while cooler polar air moves in to replace it.)
3. Discuss the effect of the earth's rotation on this north-south flow of heated air. (Air moving to the north -- a south wind -- is deflected toward the east = a SW wind; air moving to the south -- a north wind -- is deflected toward the west = a NE (trade) wind.)

4. Ask: "What other factors influence the movement of air?" (Local atmospheric conditions -- high and low pressure systems; obstructions -- mountains or high buildings; and type of surface -- asphalt, land, or water -- which influences local heating and cooling.)
5. Discuss how a sea breeze follows this general pattern of uneven heating of the earth's surface. (Air over land heats and rises; colder air over water flows in to take its place.)
6. Investigate the historical importance of the wind as a source of energy for people's use. (Moved ships; pumped water; milled grain; etc.)
7. Investigate the windmills invented by Marcellus Jacobs of Fort Myers, Florida, to produce electricity with a wind generator.
8. Move like the kind of wind which represents each of the words used to describe it at the beginning of this lesson.
9. Draw a picture of your favorite wind and a wind you are afraid of.
10. Ask: "How do airplanes use the wind?" (Take-off, landing, flight, jet stream, tail winds.)
11. Investigate how wind records and other weather records are kept.

ENERGY TO GET ENERGY

OBJECTIVE

To discover the relationship between the production of energy sources and the cost of energy.

INTRODUCING THE LESSON

1. In 1859, the first oil well drilled in the U.S. at Titusville, Pennsylvania was 69 feet deep and produced 500,000 gallons of crude oil during the first year. The crude oil sold for 60 cents a barrel. The deepest wells now go down over 30,000 feet into the earth and their crude oil will cost $20 or more a barrel. Ask: "Why is the price of oil getting higher all the time?" (There are no more 69 foot wells; equipment for drilling and refining is expensive; much energy and labor needed; new supplies are far away and in harsh environments.)
2. Collect pictures of Alaskan pipeline, offshore drilling rigs, supertankers, men working in harsh environments.

DEVELOPING THE LESSON

1. Make an in-depth study of the Alaskan pipeline: location; distance; weather; terrain; environmental impact; politics; economics; etc. (This is a classic example of just about every problem with which this lesson deals.)
2. Investigate the costs in energy (including dollars) of oil exploration, drilling, transportation to refinery, refining, transportation to user, cost to user.

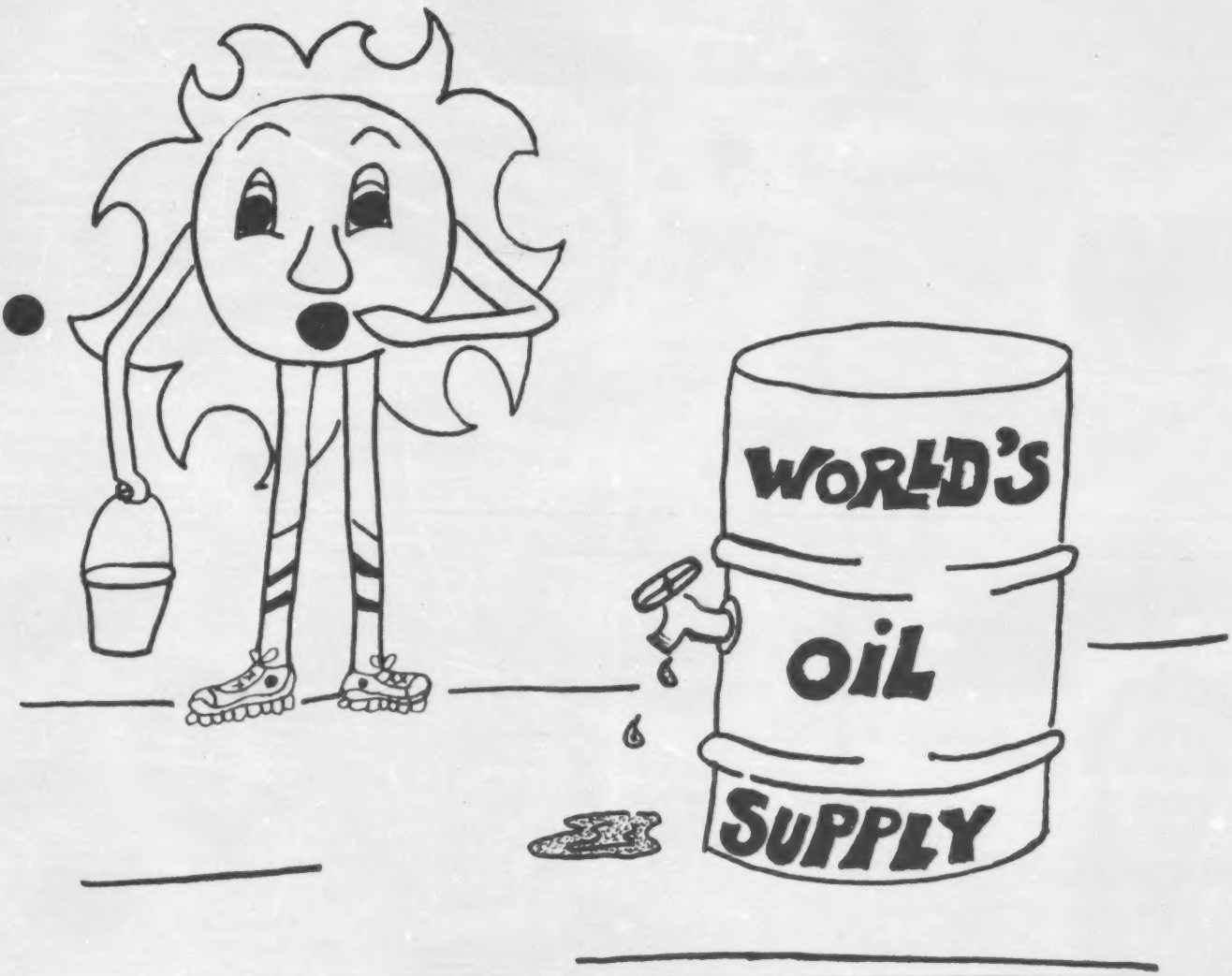
3. Ask: "Why is the price of energy getting higher all the time?" (More energy used to find it, produce it, and deliver it.)
4. Investigate process of offshore drilling for oil. (Same as on land, only platform is out over deep and rough water.)
5. Investigate the increased cost of unleaded gasoline. (Requires higher refinery temperatures and pressures; added chemicals to increase octane rating.)
6. Investigate efforts to recover additional oil from old wells.
7. Ask: "Why wasn't this oil pumped out before?" (Too costly, but it is now economically feasible as the price of oil rises.)
8. Investigate the effects of oil spills at the terminal for North Sea Oil in Scotland. (Damage to sheep and their famous Shetland wool, which is plucked, not sheared, from the sheep, and damage to seaweed on which sheep feed.)
9. Explore the effects of offshore oil rigs on marine life. (Generally good, as an artificial reef; spills may destroy whole marine environment.)
10. Draw a picture of yourself working on an oil rig.
11. Describe a world in which all energy supplies cost more to produce than the energy they contain.
12. Write a short play dealing with life after oil supplies are gone.
13. Discuss the difficulties in getting politicians to develop an energy policy and an energy conservation program. (Issues complex, involving multiple interests.)

ENERGY TO GET ENERGY

14. Investigate the results of exploration for oil in the Gulf of Mexico, along Florida's coasts, and in the Big Cypress area of southwest Florida.

15. Ask: "Is this a valid statement?" It takes several years between discovery of new energy sources and their availability on the market.

16. Has this always been true?



ENERGY AND CIVILIZATION

OBJECTIVE

To discover the relationship between energy and the development of civilizations.

INTRODUCING THE LESSON

1. Ask the students how the availability of energy has affected the development of our civilizations.
2. List the ways energy has influenced our development as a rich and powerful nation.

DEVELOPING THE LESSON

1. Trace the influence on the development of civilizations of:

   a. water wheel
   b. windmill
   c. sail
   d. fire
   e. steam engine
   g. oil
   h. slave labor
   i. internal combustion engine
   j. airplane
   k. nuclear fission

2. Investigate the role of energy in the rise and fall of former civilizations.
3. Predict the role of energy in our civilization in the future.
4. List the possible new sources of energy or inventions which will enable us to continue the development of our civilization. (Solar, nuclear fusion, etc. This could be a good review of all the proposals discussed in these energy lessons.)

5. Predict the effect on western civilization of the loss of any of the following:
   a. a complete embargo on Arab oil supplies
   b. refusal of Mexico to sell oil to the U.S.
   c. a decision to ban the use of nuclear energy
   d. replacement of fossil fuel energy with human energy
   e. synthetic products
   f. supplies of minerals (already critical)
   g. mechanized agriculture
6. What are we to do to obtain enough energy just to carry on our basic way of life in the U.S.?

THE NORTH WIND AND THE SUN

OBJECTIVE

To discover the relationship between people and the sun throughout the ages.

INTRODUCING THE LESSON

1. Read to the class the song to the sun written by St. Francis of Assisi in 1224.

> "Praise to you, my Master, for all your creatures,
> Foremost for lordly Brother Sun
> Who lights our daytime for us.
> He is a beautiful thing who spreads forth a great splendor,
> Of You Most High, he is the visible emblem."

2. Ask: "Why have people through the ages felt such strong emotion when they contemplated the wonders of the sun?"

DEVELOPING THE LESSON

Have students read the legend of The North Wind and The Sun. Discuss each of the following questions.

1. What property of the sunshine caused the Traveler to remove his cloak?
2. How can this property of the sun be used to benefit man?
3. Why is this property compared to "gentleness and kind persuasion" in the moral?
4. What about the shade? How does man use shade to keep cool?

THE NORTH WIND AND THE SUN

The North Wind and the Sun had a quarrel about which of them was the stronger. While they were disputing with much heat and bluster, a Traveler passed along the road wrapped in a cloak.

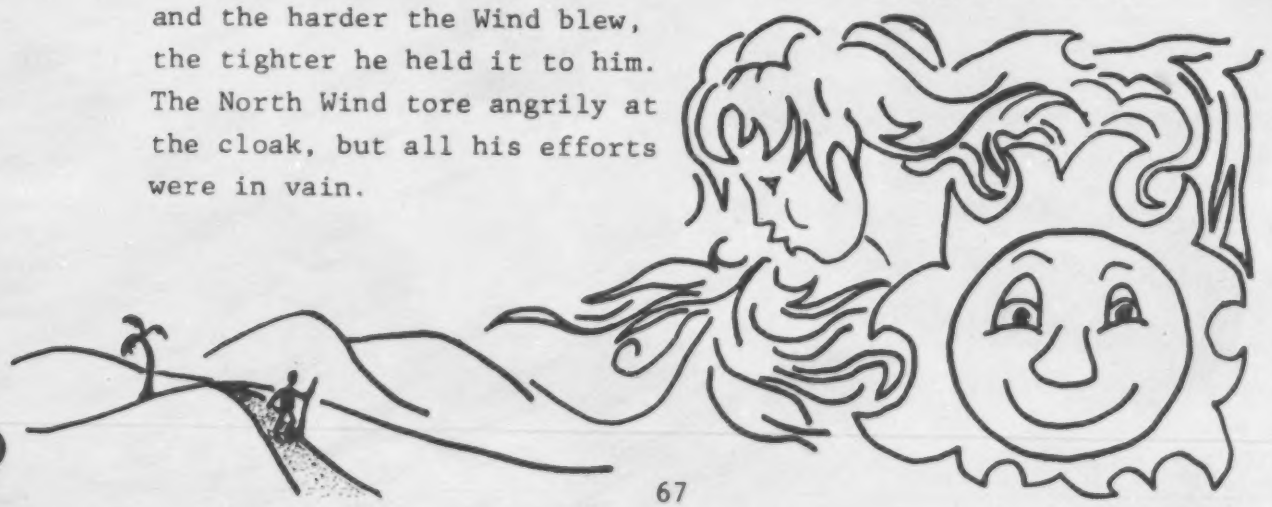
"Let us agree," said the Sun, "that he is the stronger who can strip that Traveler of his cloak."

"Very well," growled the North Wind, and at once sent a cold, howling blast against the Traveler.

With the first gust of wind the ends of the cloak whipped about the Traveler's body. But he immediately wrapped it closely around him, and the harder the Wind blew, the tighter he held it to him. The North Wind tore angrily at the cloak, but all his efforts were in vain.

Then the Sun began to shine. At first his beams were gentle, and in the pleasant warmth after the bitter cold of the North Wind, the Traveler unfastened his cloak and let it hand loosely from his shoulders. The Sun's rays grew warmer and warmer. The man took off his cap and mopped his brow. At last he became so heated that he pulled off his cloak, and, to escape the blazing sunshine, threw himself down in the welcome shade of a tree by the roadside.

MORAL: Gentleness and kind persuasion win hwere force and bluster fail.



SOLAR FOLKS

OBJECTIVE

To discover through research how people have worked with solar energy over the years.

INTRODUCING THE LESSON

1. Ask students to collect pictures of the sun for a bulletin board display.

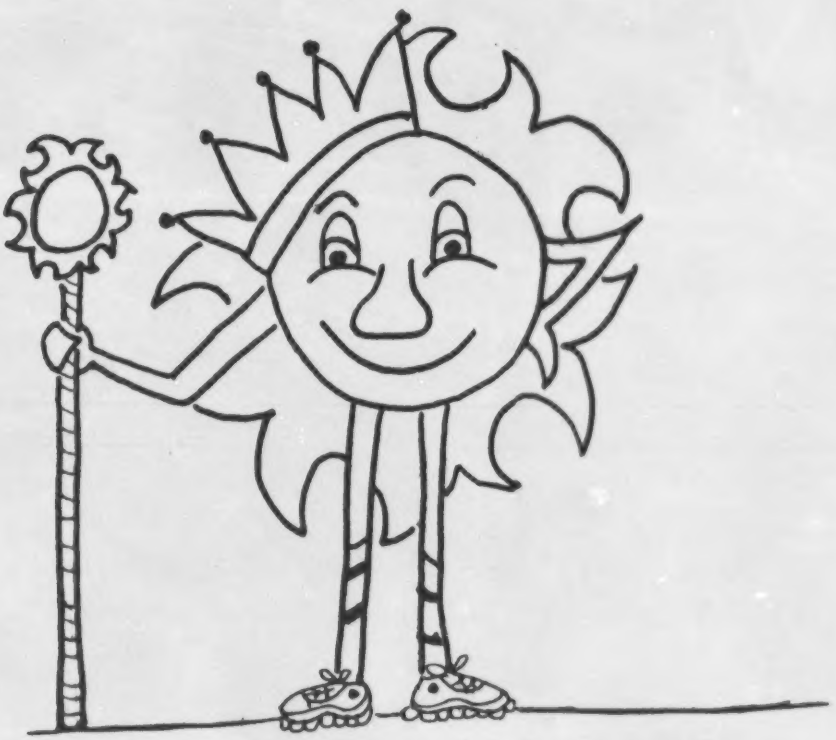
DEVELOPING THE LESSON

1. The mean daily solar radiation is measured in Langleys. This is a direct measure of the amount of solar energy received at a given location. Langleys were named for Samuel Langley, a pioneer in aeronautics and solar energy. What can you find out about Mr. Langley?
2. The reign of Louis XIV of France (1643-1715) was an era of solar experiments. Louis gained the title of Sun-King. Why?
3. Archimedes saved the Greek city of Syracuse from Marcellus and his Roman fleet by using reflectors to concentrate solar energy on invading ships. The fleet caught fire and burned. During the siege of Constantinople, another Greek, Proclus, remembered history and burned another enemy fleet. Is there any credibility to these stories?

SOLAR FOLKS

4. In 1695, Georges Buffon proved the potential of concentrating solar energy by igniting wood at 200 feet, and melting lead at 130 feet. He used a parabolic-shaped mirror. How are these mirrors used today?

5. Antonie Lavoisier (1743-1794) built a solar furnance with curved glass sections filled with wine. The furnace was used to melt platinum at about 2,000°C. How are solar furnaces being used today?



SOLAR ENERGY AND THE ANCIENT GREEKS

OBJECTIVE

To discover the uses of solar energy in the development of the ancient Greek civilization.

INTRODUCING THE LESSON

1. Ask students why the ancient Greeks might wish to develop the use of solar energy in their city-states.
2. Discuss the veneration of the sun by the ancient Greeks.
3. Read to class excerpts from A Golden Thread by Ken Butler and John Perkins - Chaper 1, Solar Architecture in Ancient Greece. (Pub. Cheschire Books)

DEVELOPING THE LESSON

1. Ask: "Were the ancient Greeks faced with any fuel shortages?" "What did they use for fuel?"
2. Discuss methods of conservation the Greeks developed to solve energy problems. Compare these methods with current methods of conservation.
3. Investigate Socrates' idea about the ideal Greek house.
4. Investigate the use of solar energy as a response to conservation in the heating and cooling of Greek houses.
5. Describe how Greek cities were designed to take advantage of the sun.

6. Find examples of Greek sun worship. Research the role the sun played in Greek mythology and culture.
7. Design a Greek home using solar energy.
8. Make a bulletin board of a Greek city-state using solar energy.
9. Ask: "How did the ancient Greeks make use of solar energy in their architecture?"
10. Discover the design principles that served as a basis for Greek solar architecture.
11. Read to the class the story of Olynthus (North Hill), a planned solar city - Chapter 1, A Golden Thread, by Ken Bulter and John Perkins.
12. Ask: "How did the construction of Olynthus fit in with the democratic ideas of the time?"
13. Draw and label an Olynthus house indicating directional exposure.

SOLAR ENERGY AND THE ANCIENT ROMANS

OBJECTIVE

To discover the uses of solar energy in the ancient Roman Empire.

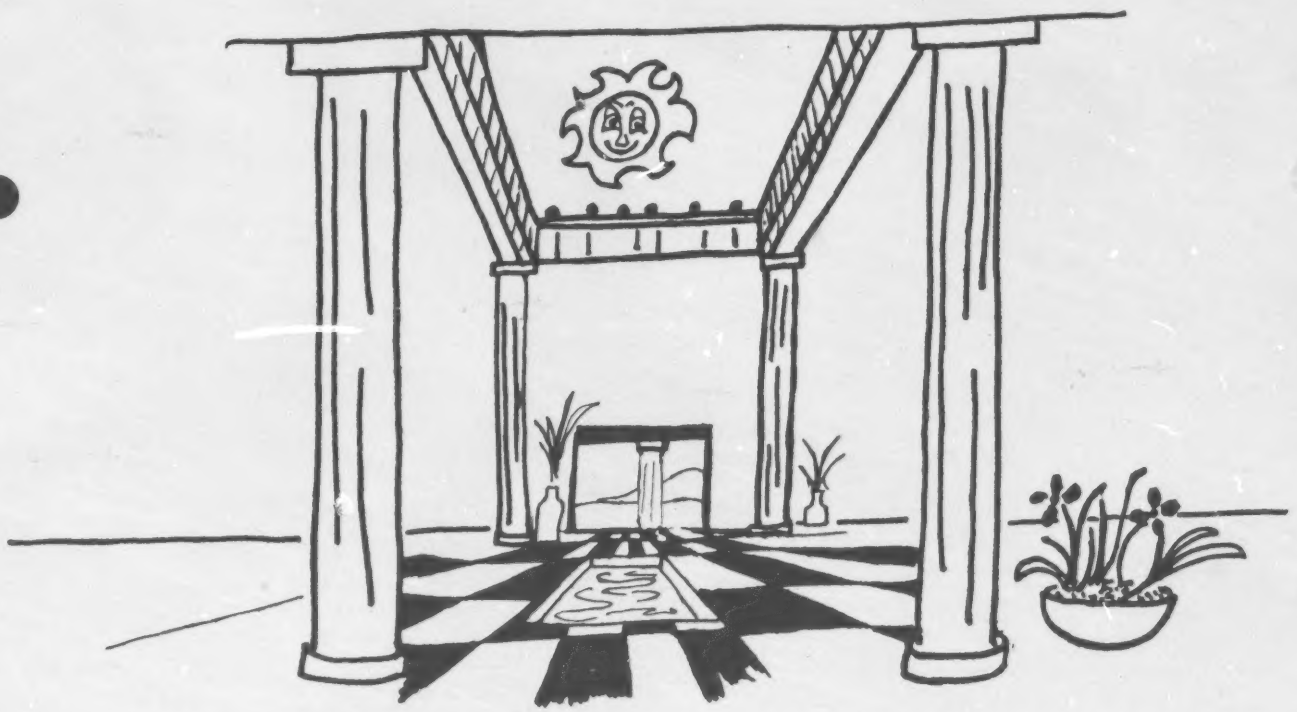
INTRODUCING THE LESSON

1. Ask students, "What did the ancient Romans use for fuel?" "Where did they get their fuel supplies?"
2. Read to class excerpts from A Golden Thread by Ken Butler and John Perkins - Chapter 2, Roman Solar Architecture (Pub. Cheschire Books)

DEVELOPING THE LESSON

1. Ask: "Were the ancient Romans faced with any fuel shortages?'
2. Discuss methods of conservation the Romans developed to solve energy problems.
3. Ask: "How were the Romans more advanced than the Greeks in their use of solar energy?"
4. Ask: "How did the use of solar energy in houses differ in different parts of the empire?"
5. Describe how Pliny the Younger (writer of second century Rome) used the sun to heat his villas. Ask: "What was his purpose in using solar energy?"
6. Ask: "What was a heliocaminus?"
7. Research the use of window coverings by the ancient Romans.

8. Ask: "How did the Romans use a solar heat trap to develop greenhouses and cultivate plants?"
9. Describe how the Romans used solar heat to help warm their public baths.
10. Research how the ancient Romans developed a floor covering that was an absorber of solar energy.
11. Research the opinion written into the Justinian Code in the sixth century concerning solar heated buildings.



SOLAR ENERGY, PAST AND PRESENT

OBJECTIVE

To discover how people throughout the ages have worshiped the sun and its energy.

INTRODUCING THE LESSON

1. Ask the students to collect pictures of the sun, sunrises, and sunsets.
2. Make a bulletin board display of the pictures.

DEVELOPING THE LESSON

1. Ask the students to draw a picture which expresses their feelings about the sun.
2. Find examples of modern "sun worship".
3. Ask: "How has modern sun worship affected industries in Florida?" (Suntan lotions, retirement, vacations.)
4. Investigate the worship of the sun god "RA" in ancient Egypt. (Pyramid inscriptions on inside walls of Sixth Dynasty B.C. -- depict the sun god "RA" carrying the Pharoah's soul on his sky boat into the west, where lay the land of the dead.)
5. Read in National Geographic magazine, November 1970, about the restoration of Akhenaton's Temple to Aten, the solar disc.
6. Investigate the Akhenaton concept of a single supreme sun god, the solar disc -- the unification of all the former sun gods into one image of Aten. (This concept influenced religious thought in the Middle East until the time of Jesus and Muhammed.)

7. Read to the class and discuss this passage from the Vedic Hymns (Hindu), circa 1400 B.C.: "And when the Sun arose, they could not understand how this newborn God could wield such power. And they said, 'Let us worship this Child of the Sky. He stands up as a mighty flame; he stretches wide his arms; he is everywhere like the wind.'"

8. Investigate this Vedic concept's influence on the writing of Thoreau. (See "Walden", Chapter 2, for insight into Thoreau's regard of the sun as the visible symbol of some yet-to-be-evolved human grandeur. Throughout "Walden" he compares daybreak with spiritual awakening.)

9. Have one of the students read Walt Whitman's "Song of Myself" (a primitive psychological idea that light from an inner sun is emitted through the eyes and mixes with the eternal light of the sun to make visual perception possible -- a notion as old as Empedocles, 5th Century B.C.).

10. Investivate the "CIWILTKONIA", a sun ceremony of the Papago Indians of the Southwestern United States. (Dancers circle a sand painting of the sun and thereby recharge themselves with its life-giving energy.)

11. Read to the class Franz Boas' description of the "Prayer at Sunrise" of the Pacific Northwest Kawkiutl Indians, and ask the students to discuss: "Welcome, Great Chief, Father, as you come and show yourself this morning. Let nothing evil befall on me this day which you have fashioned according to your wishes, Great One, Walker-Across-The-World, Chief."

12. Research the role that the sun played in the daily lives of the Aztecs, Incas, Mayas, and Natchez Indians of the Americas.

LIFE WITH LIMITED ENERGY

OBJECTIVE

To discover the relationship between people's life-style and their use of energy.

INTRODUCING THE LESSON

1. Ask the class to collect pictures and news stories of energy supply and use in the nations of the world. (Be sure not to overlook human power.)
2. Assign each student one nation to study and report on.
3. Make a bulletin board display of the pictures and news stories collected.

DEVELOPING THE LESSON

1. Ask each student to give a short report on energy supply and use in the assigned nation.
2. Investigate patterns of energy supply and use in rural, suburban, urban, and inner city areas.
3. Compare these areas in terms of energy use; energy waste.
4. Compare them in terms of energy conservation.
5. Have the class pick out the five nations that seem most unusual or different from the average in terms of energy use and compare them in terms of:

   a. food
   b. industry
   c. agriculture
   d. transportation
   e. use of electricity
   f. most common fuel

6. Do a similar comparison for states in each section of the U.S.

LIFE WITH LIMITED ENERGY

7. Discuss the relationships of energy use and environmental problems; for example: firewood for cooking is scarce, so people use dried cow manure for fuel. This causes shortage of fertilizer, which results in a smaller crop; less food to cook.
8. Investigate the Kaplan project in Bartow, Florida which uses wastes from cattle feed lots to produce methane gas.
9. The U.S. has 7% of the world's population, but uses 35 to 40% of the world's energy. Discuss how the U.S. must depend on other nations for some of its energy supplies.
10. Discuss the relationship between energy use and life-styles.
11. Draw a picture of yourself in an energy-poor country.
12. Now draw a picture of yourself in the U.S. if energy supplies are limited.
13. Discuss the differences between your pictures.

LIFE-STYLES AND ENERGY

OBJECTIVE

To discover the relationship between energy supplies and standard of living.

INTRODUCING THE LESSON

1. Ask the students to invent a way to compare the energy demand for the basic needs; the "wants"; and the dreams of people.
2. Ask them to share their inventions with the class.

DEVELOPING THE LESSON

1. Have the students make an energy formula that measures the differences between people's energy "needs" and energy "wants".
2. Draw a picture to include in a class mural that shows how energy shortages cause changes in societies and the way people live (life-styles).
3. Discuss how such changes in people and societies could lead to conflict.
4. Show how governments and people use energy supplies to make other governments and people do things they want (oil embargo, food exports, etc.).
5. Compare energy needs and wants in the U.S. with those in other nations.
6. Compare different energy needs and life-styles within the U.S.

7. Do the same for your community. (How many private airplanes are there, for example?)
8. Create a dance, a verse for a song, a poem or a picture which shows how we use energy to maintain our life-style or standard of living.
9. Share your creation.
10. Add to the class energy word list.

CHANGING LIFE PATTERNS

OBJECTIVE

To discover the relationship between the life-styles of people and the amount of energy available for their use.

INTRODUCING THE LESSON

1. Ask the students to list ways the energy shortage has affected their lives.
2. Make a class list of changes in life-style brought about by the energy shortage.

DEVELOPING THE LESSON

1. On the basis of the class list, discuss which energy shortage or use seems to be the one most closely associated with their lives. (Probably gasoline for the family automobile.)
2. Discuss whether the energy shortage has really changed the standard of living of people. (Only a change in wasteful habits such as driving to the store for a single item they forgot. U.S. living standards are still climbing - latest tallies for automobiles, appliances, furniture, and other durable goods total $1.35 trillion -- $6238 for <u>every</u> person in the U.S. That's a 47% increase since 1970.)
3. Ask the class to describe the American life-style. Are we greedy, selfish, lazy, thrifty, spoiled, whatever?

CHANGING LIFE PATTERNS

4. Discuss the relationship between life-style and standard of living. (How we live versus level at which you live -- you may enjoy a high standard of living and be very frugal.)

5. Is there a relationship between standard of living and energy use? (Definitely, energy is the essential element.)

6. Go out and find examples of how people's use and the supply of energy affects their standard of living:
   a. transportation -- bicycle or gas guzzler?
   b. diet -- soup and crackers or steak?
   c. life-style -- debt or savings?
   d. occupations -- unskilled or professional?
   e. recreation -- rowboat or cabin cruiser?
   f. agriculture -- family farm or agri-business?

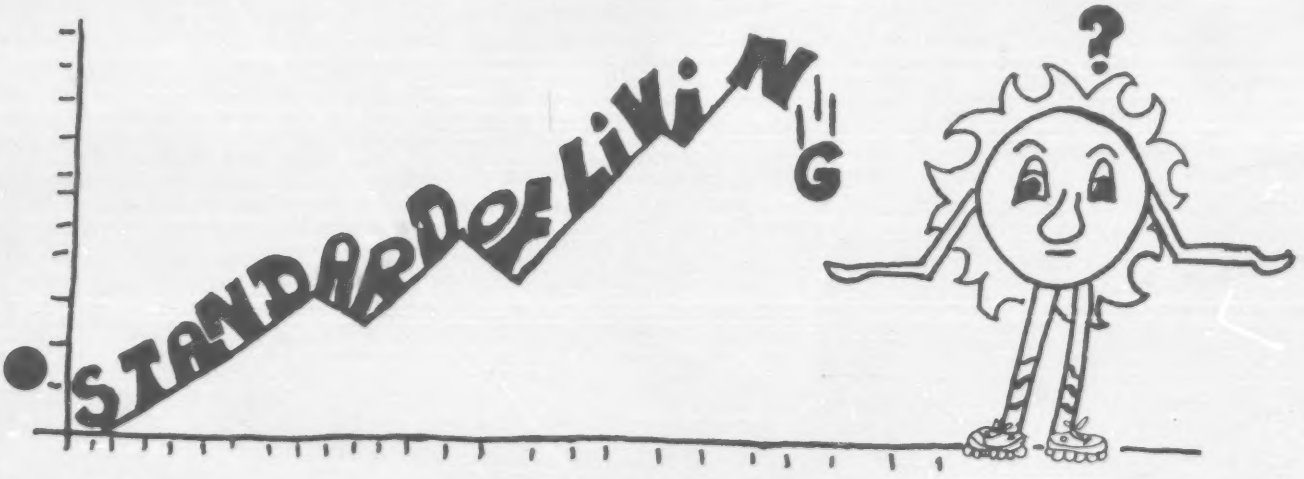
7. Suggest ways to reduce use of energy in each example

8. How do people's use of energy reflect their values?

9. Discuss the validity of the statement: "Energy shortages cause changes in societies".

10. How about effect on individuals?

11. Has the energy shortage affected your community's standard of living? or only its habits?



SOCIETIES CHANGE

OBJECTIVE

To discover the relationship between energy supplies and the lives of people.

INTRODUCING THE LESSON

1. Ask the students to compare their energy use with that of an Eskimo.
2. Ask: "How is the comparison changing?" (Eskimos now have electricity, snowmobiles; rarely use dog sleds and whale oil lamps.)

DEVELOPING THE LESSON

1. Compare people's needs for energy in an industrial nation with that of a developing nation.
2. Investigate the development of the "Green Revolution". (Name for intensive program to increase food production in Asia and South America by American scientists.)
3. Ask: "What were the major ingredients of the program?" (Hybrid seeds, fertilizers, irrigation, pesticides, and farm machinery, all high energy users.)
4. Investigate problems which resulted when high energy farm methods were introduced into nations with limited energy and money. (Loss of disease-resistant native varieties of rice and wheat, lack of water for irrigation, costs.)
5. Ask: "What kind of energy are the poor people of the world interested in?" (Food for human energy or fuel for cooking.)

6. Check the validity of the statement: "If the poor people of the world had all the food they needed, they would not have enough fuel to cook it". (True)
7. If this statement is true, discuss its implications for the future. (Overpopulation can only increase shortages.)
8. How has the increase in the world's population affected various societies and nations?
9. Calculate how many people the earth could support at the U.S. standard of living. (Our 200 million people use nearly one-third of the world's energy, so the earth could support three times as many people as the U.S. standard of living or 600 million.)
10. How many could the earth support at the standard of living of the people of China? (1 billion people use less than 10% of the world's energy = over 10 billion.)
11. Draw a picture showing Americans visiting a poor nation.
12. Draw a mural showing poor people visiting the U.S.
13. Draw a picture of yourself in a new society that has been forced to live on a limited energy budget.
14. Describe your new society and life in it.
15. List the items you own but would have to give up in the new society.
16. Ask: "Is it fair for our society to use up the fuels on which future societies must depend?"

SOLAR ENERGY - PEOPLE AND THE SUN

OBJECTIVE

To discover the relationship between people and the sun throughout the ages.

INTRODUCING THE LESSON

1. Read to the class the song to the sun written by St. Francis of Assisi in 1224:

   "Praise to you, my Master, for all your creatures,
   Foremost for lordly Brother Sun
   Who lights our daytime for us.
   He is a beautiful thing who spreads forth a great splendor,
   Of You Most High, he is the visible emblem."

2. Ask: "Why have people through the ages felt such strong emotions when they comtemplated the wonders of the sun?"

DEVELOPING THE LESSON

1. Ask the students to comment on Henry Thoreau's comparison of daybreak and the rising of the sun with spiritual awakening.
2. Write a new verse to the John Denver song, "Sunshine".
3. Find two or more authors who have written about sun power and compare their descriptions of the sun.
4. Write a poem which expresses your feelings about the sun.
5. Investigate Inca worship of the sun.
6. Find pictures of the Inca temples to the sun "Father".

7. Find "Sun Fathers" in other cultures.

8. Investigate how the culture of the Sioux Indians looked beyond the power of the sun to people's responsibility to use it wisely, and discuss how well we have heeded the advice of the Sioux.

9. Read the following passage from the Papago Indian ceremony to the sun:

"In the east is the house of the sun.
Up over the top of his roof-beam
The sun climbs and journeys
Over the heads of us
Who make our journey below him.
I stretch my right hand sunward,
Then trace upon my body
The ritual sign."

(This ritual, called a "CIWILTKONA", is performed by dancers who believe that they recharge themselves with the sun's energy as they circle a sand painting of the sun.)

AMERICAN INDIANS AND THE SUN

OBJECTIVE

The students will study the role that the sun played in the lives of the American Indian tribes.

INTRODUCING THE LESSON

The Indian tribes that migrated to and settled in the Americas had many beliefs and superstitions. Tribes like the Aztecs, Mayas, Incas, Natchez, and others all held the sun in great esteem for many reasons.

DEVELOPING THE LESSON

1. Research the daily lives of some of the indian tribes which inhabited the Americas.
2. Describe the role that the sun played in beliefs of the tribes listed above.
3. List contributions of those tribes as they pertain to the use of the sun.
4. Map study: Illustrate, by drawing a map, where those tribes were located.
5. Be able to discuss how the indians were treated by the white man. The student may concentrate on how various explorers like Cortez, Pizarro, and Champlain reacted to these people.
6. Demonstrate an ability to define and understand the specialized vocabulary of American History listed below:
   a. Incas
   b. Aztecs
   c. Mayas
   d. Natchez
   e. conquistador
   f. human sacrifice
   g. "sun god"

ENERGY CONFLICT

OBJECTIVE

To discover the relationship between supply and demand for energy.

INTRODUCING THE LESSON

1. Divide the class into 6 groups; each group controls all of one of the following resources in the world: wood; oil; coal; uranium ore; hydro-electric power; irrigation rights. (You may want to have a group for raw materials.)
2. Ask each group to meet to consider how it would use its monopoly of one resource to exert influence or power on the rest of the world.

DEVELOPING THE LESSON

1. Ask each group to design a butcher paper display to show their plan for exerting their power in world politics. (They may use charts, graphs, drawings, whatever.)
2. Have each group present their plan to the class. (You will be able to judge the time allotted by the interest shown in the preparation of the group presentation.)
3. Discuss any apparent conflicts which may have to be resolved.
4. Form a committee of one member from each group to meet to discuss any possible compromises that might be worked out to resolve conflicting positions.

5. Have the committee report to the class, and discuss the committee proposal.

6. Ask: "What happens if the conflicting plans cannot be resolved in committee?" (Conflict, war)

7. Investigate the history of energy conflict.

8. Find out what resources people fought for in wars in which the U.S. was involved:

   a. Revolutionary
   b. Spanish-American
   c. Civil
   d. World War I
   e. World War II
   f. Korean
   g. Vietnam
   h. Middle East

9. Do the same for ancient wars: Persian; Greek; Roman; French-Russian.

10. Investigate the influence of Nigeria's oil supplies to the U.S. on American policy toward Rhodesia. (Recognition of new government might offend Nigeria.)

11. Ask: "Why did some U.S. officials recommend military action to guarantee Mid-East oil supplies to the U.S.?" (Oil supplies so vital to national interest that cut-off of oil supplies is considered an attack on the U.S.)

12. Find people who wage quiet wars with human energy.

13. Find others who use their energy to make peace.

ENERGY ON THE FARM

OBJECTIVE

To discover the relationship between energy use and agricultural production.

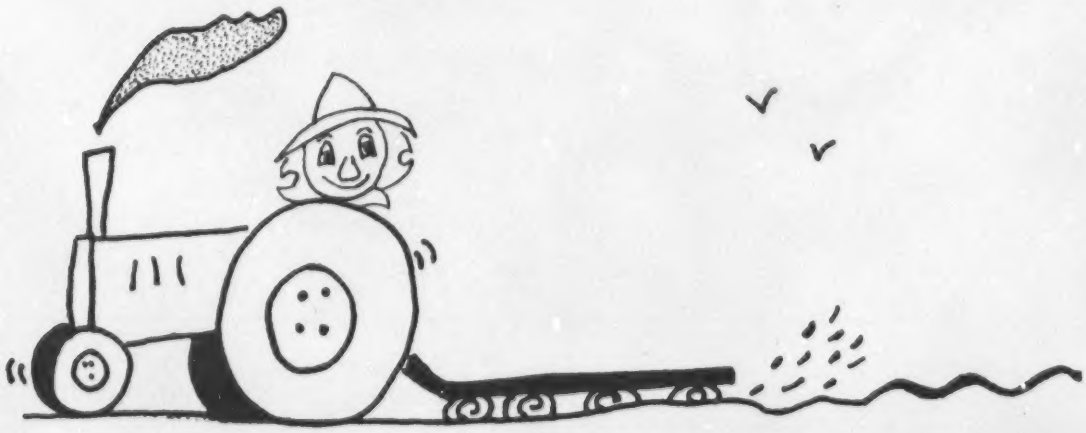
INTRODUCING THE LESSON

1. In the U.S., we now use six times more calories of energy to produce our food than the food contains. Compare the farm of 100 years ago with a modern farm in terms of energy use.
2. Collect pictures of past and present farming methods and compare the apparent use of energy.

DEVELOPING THE LESSON

1. Ask: "What is the major difference between a 'small' farm and a modern 'agri-business'?" (Consider size, type, and variety of crops raised, use of machinery, etc.)
2. Ask: "What is the major difference between agricultural methods of today and 100 years ago?" (Oats and animals to do work instead of gasoline and machinery; monoculture instead of crop variety; synthetic fertilizers instead of manure; irrigation, etc.)
3. Note the similarities between the small family farm and the farms of the past.
4. Investigate the effects of monoculture (one crop) on the use of energy. (Need more pesticides, fertilizers.)

5. Ask: "How has the need for pesticides increased with the practice of monoculture?" (Whole fields of crops of only one kind provide a haven for the insects that live on that particular crop species, so they would multiply tremendously if not controlled with poisons.)
6. Farmers say that the cost of wheat is only a small part of the cost of bread. Ask: "What makes the cost so high?" (Transportation, packaging, marketing -- all high energy users.)
7. Draw a mural showing the development of agriculture in the U.S.
8. Discuss the effect on the U.S. economy of exporting farm crops which have been produced at great energy expense.
9. Investigate the farming practices of China. (Use of human labor, manure, etc.)
10. Investigate the potential for competition between farmers, truckers, auto owners, and boat owners for scarce diesel fuel.



SOLAR ENERGY AND EXPLORATION

OBJECTIVE

To show how solar energy played an important role in the discovery and exploration of America.

INTRODUCING THE LESSON

The heat from the sun causes evaporation of water. As this process takes place air movement also occurs. It is in this way that winds are created. The wind of course was harnessed by explorers to power their sailing ships. This type of transportation was the most common method of ocean travel up to the late 1800's.

DEVELOPING THE LESSON

1. Research how winds are formed.
2. Illustrate through drawings how the sailing ship has progressed over the years. (Types of ships may be assigned to different groups to research.)
3. Give reasons for the discovery of America.
4. Name famous explorers and identify the areas claimed for their native land.
5. Map study: Illustrate the routes of the early explorers.
6. Demonstrate an ability to define and understand the specialized vocabulary of American History listed below:
   a. circumnavigate
   b. commerce
   c. navigation
   d. Vikings
   e. planetary winds
   f. Crusades
   g. cartography
   h. astrolabe

SOLAR ENERGY AND THE AMERICAN COLONIAL PERIOD

OBJECTIVE

To give students an overview of the role that solar energy played in everyday life during the Colonial Period of American history.

INTRODUCING THE LESSON

The resource that the early colonists used in great abundance was wood. This item was used for fuel, furniture, homes, utensils, shade, etc. Trees of course are the source of wood. Without the sun's energy carrying out the process of photosynthesis we would have no such product.

DEVELOPING THE LESSON

1. Make a detailed list of all the uses of wood in the daily lives of the colonists.
2. Draw a diagram showing how the process of photosynthesis works.
3. Bring in a product made of wood that is in widespread use today.
4. Decide from a map (hypothetical) where the best place would be to establish a settlement. Students would list their reasons and present them to the class for discussion.
5. Research the building field today and report on the increased dependence of wood as a building material.
6. Demonstrate an ability to define and understand the specialized vocabulary of American History listed below:
   a. log cabin
   b. saw-mill
   c. frontier
   d. cash crop
   e. naval stores
   f. subsistence farming
   g. draw knife
   h. cabinet maker
   i. apprentice
   j. indentured servant

ENERGY, ENVIRONMENT, AND MAN

OBJECTIVE

To learn about the inventors and scientists whose work made our high energy society possible and the changes that resulted from their inventions, both to people and to their environment.

INTRODUCING THE LESSON

1. Read about the inventions of Thomas Alva Edison. (Free booklets available from Florida Power & Light Co.).
2. Ask the students to describe the first light bulb, battery, and power station.

DEVELOPING THE LESSON

1. Investigate the work of Watt, Volta, Ohm, Ampere, Faraday, Black, Fahrenheit, Celsius, Franklin, Joule, Carnot, Young, Einstein, Fermi, and Galileo.
2. Ask: "Why do some of these names seem familiar?" (Many of their inventions were named for them.)
3. Ask: "What is a kilowatt?" (1000 watts)
4. Write a letter to Thomas Edison describing the effect that his invention has had on your life and the life of your community.
5. Read about the work of Henry Ford and John D. Rockefeller in the development of energy and transportation.
6. Ask: "What effect has the automobile and gasoline had on the life styles of people?"
7. Discuss the changes which resulted from other energy inventions and discoveries. (Steam engine, nuclear, etc.)
8. Draw a picture of your life without gasoline or electricity.

SOLAR INVENTIONS

OBJECTIVE

To have students develop an understanding of the Industrial Revolution as a period of change and the role solar energy played during this time.

INTRODUCING THE LESSON

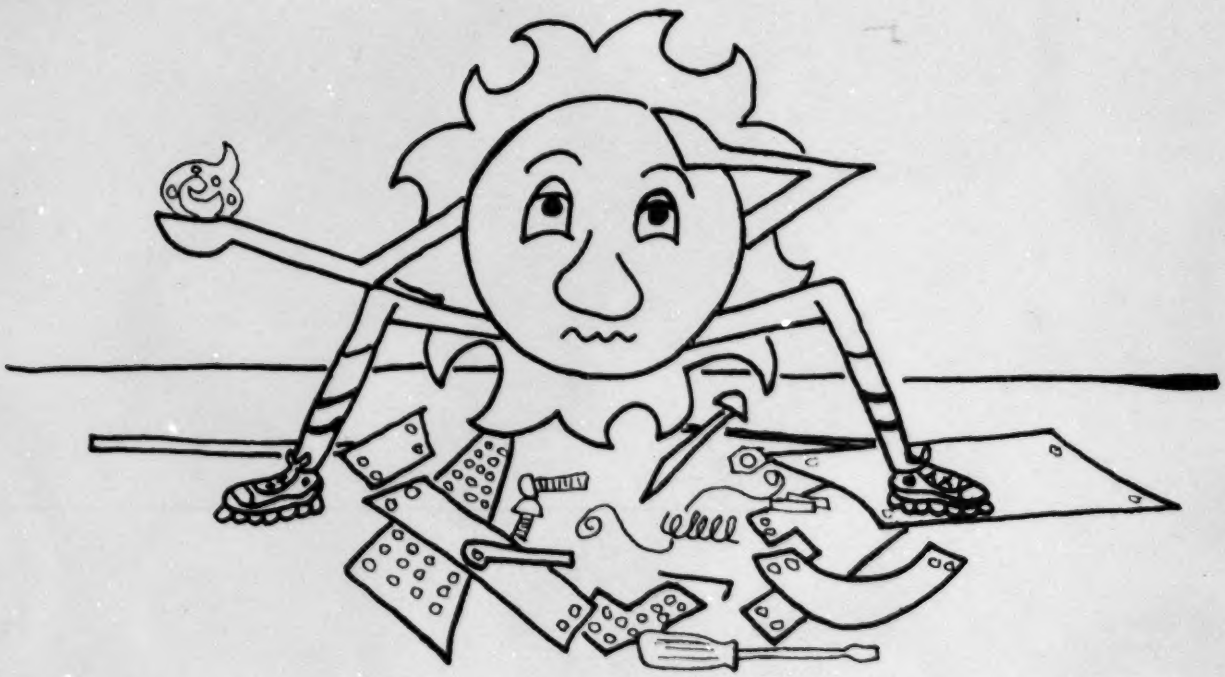
America owes a lot to the ingenuity of a few inventors who have contributed items which make our lives easier. Many of these inventions came into existence during the time we refer to as the Industrial Revolution.

The Industrial Revolution saw the change in the production of goods from hand to machine and from homes to factory. These changes affected the lives of most people in some way. Each new idea seemed to spark another new idea and this process was an on-going one.

DEVELOPING THE LESSON

1. Identify leading industrial inventors and tell the invention for which they are famous.
2. Use an invention as a guide and improve upon it by using solar power. Example: A sailing ship with photovoltaic cells instead of canvas for sails.
3. Show how the evolution of the clipper ship helped make the United States a leader in world trade.
4. List the reason why the textile industry was most affected initially by the Industrial Revolution.
5. Research the role that John Ericsson, the inventor of the Union ironclad Monitor, played in the building of a solar engine.

6. Describe how the factory system promoted the growth of cities and discuss some of the problems which came about as a result of this growth.
7. Demonstrate an increasing ability to define and use specialized vocabulary of American History listed below:
   a. division of labor
   b. interchangeable parts
   c. patent
   d. standardized parts
   e. steam engine
   f. urbanization
   g. cottage industry
   h. Eli Whitney
   i. photovoltaic cells



THE INFLUENCE OF THE SUN ON MAN'S DWELLINGS

OBJECTIVE

To identify the relationship between the energy of the sun and life on earth.

INTRODUCING THE LESSON

1. Ask the students to complete the following phrase: "Solar radiation is ...." Consider its nature, appearance, effects, capture by plants, use by animals and man.
2. Discuss the student responses and make a list of possible topics for further discussion and investigation.

DEVELOPING THE LESSON

1. Follow up on ideas for activities from the discussion above.
2. Investigate the solar achitecture of the Pueblo Indians -- design for heating, cooling, ventilation, illumination, and integration with natural cycles of season and climate.
3. Ask: "How does this solar architecture correspond to animal structures -- bee hives, ant hills, animal burrows, birds' nests, etc.?
4. Ask: "Why has modern man lost the art of solar architecture in the high-energy society?" (Air conditioning has replaced mental skills and ingenuity in dealing with nature.)
5. Investigate the suggestions for siting and orientation of houses, buildings, and even cities with regard to the sun, prevailing winds, and other climatic and geographic features by the ancient Roman architect Vitruvious in the time of the Emperor Augustus.

6. Investigate the design and construction of the buildings of the Seminole and Miccosukee Indians of Florida.
7. Ask: "Why were early American barns painted red?" ("Paint" was skim milk mixed with iron oxide (rust) and lime, which absorbed sunlight -- a "solar heating device".)

THE OLD RED BARN

During colonial days, a painted farmhouse or barn was a rare sight. Farmers looked upon paint as a needless extravagance, but tastes change. As life in the settled areas became easier, farmers began to paint their barns, which were more important to them than their houses.

By the early 1800's, the red barn had become a familiar sight in the countryside. But why red? Why not brown or green? Or, for that matter, why not blue or yellow?

One explanation is that farmers had to make their own paint, and red was the easiest color to mix. They made the paint itself from a mixture of skimmed milk, lime, and glue from cow's hoofs. For the coloring matter, they first tried using blood from the farm animals, but the results were not very satisfactory, especially for outside paint. Finally, farmers settled on iron oxide, which was available in most localities.

Eventually, scientists discovered that red was an excellent color for barns because it absorbed the sun's rays and kept the buildings warmer in winter. But the early settlers had no way of knowing this. They painted their barns red as a matter of convenience. Long before paint manufacturers started in business, the red barn had become a tradition in American life.

8. Predict the future for buildings like the World Trade Center Twin Towers, with over 100 stores and no insulation or windows that will open. Discuss how a building like this could have been designed and constructed. (Energy was so cheap that there was no reason to be concerned about the costs of heating, cooling or lighting.)
9. Investigate modern solar architecture in the U.S. to determine how it is like -- or unlike -- ancient solar architecture.

A PASSIVE SOLAR HOUSE

OBJECTIVES

1. To understand the basic features required in a simple passive solar heating design.
2. To apply knowledge of vegetation to landscaping arrangements that conserve energy in buildings.
3. To apply knowledge of the angle of the sun during different seasons to the problem of building design.

INTRODUCING THE LESSON

Orient a house and landscape the lot to get maximum benefit from the sun's energy without using complex solar collecting systems. Be imaginative and you might be able to make suggestions to others which will help them more effectively utilize the sun's energy.

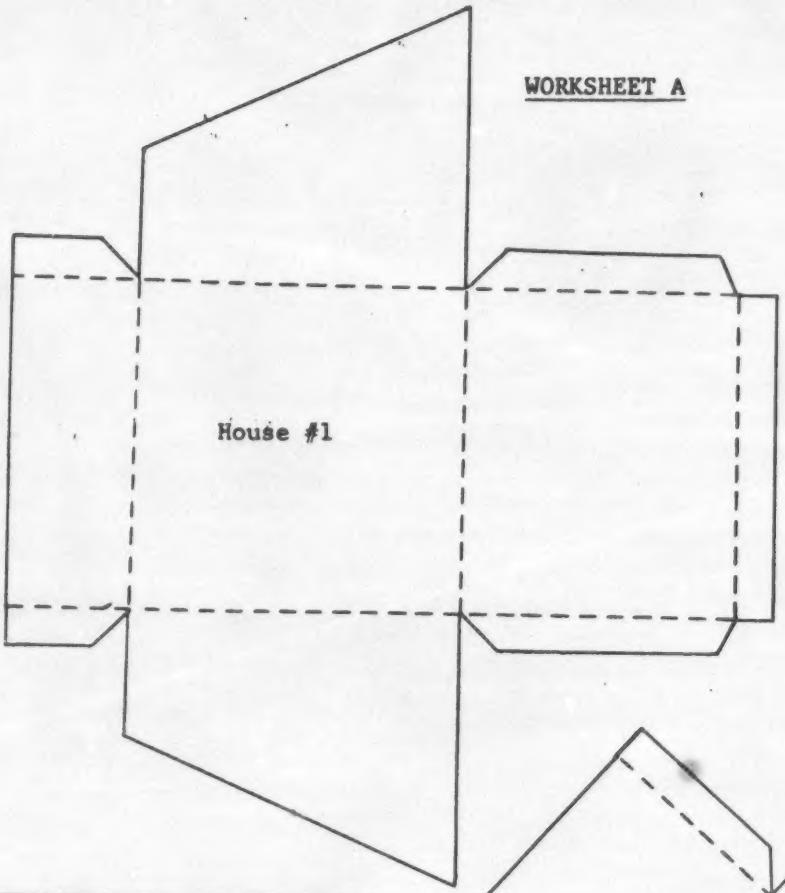
1. Cut and fold the model dwelling and assemble without taping. (Worksheet A)
2. Place the folded model dwelling on the plot plan (Worksheet B) and decide on the setting of the dwelling. Make decisions about the room, windows, and door placements. Unfold the dwelling and draw in the windows and doors.
3. Refold and tape the dwelling. Then tape the roof in place. Place the taped model dwelling on the plot plan. Cut out the model trees and shrubs and fold the bases. Use as many tree models as you desire to landscape the plots by taping the models in place. Remember, most deciduous trees lose their leaves in fall.
4. Set the light source at the approximate angles for the winter and summer sky. Check the effectiveness for winter heating and summer shading of your landscaped plot. Be sure to replace summer deciduous models with winter models and visa versa.

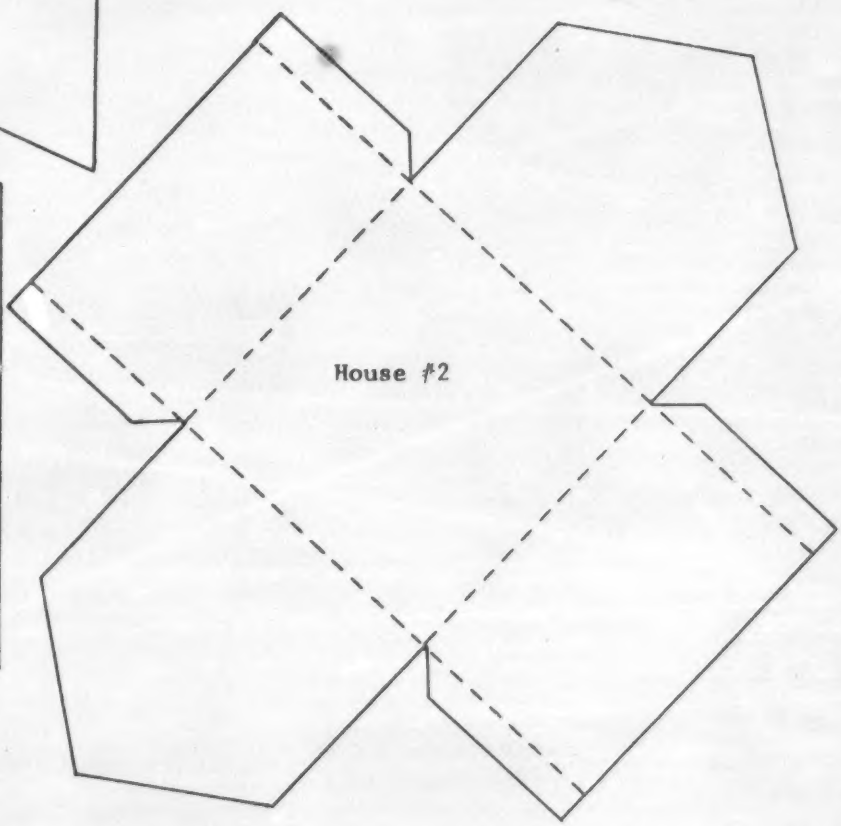
A PASSIVE SOLAR HOUSE

DEVELOPING THE LESSON

1. How does your dwelling compare to those of other students in placement of windows, size of doors and roof arrangements?
2. What are common procedures in landscaping passive solar homes?
3. In which direction should the largest roof overhand face to take advantage of winter sun while avoiding summer sun? .
4. Obtain other copies of Worksheets A, B, and C. Redesign and landscape the same house for an active solar energy heating system. Place flat plate solar collectors on the roof. Determine the most efficient roof pitch for such a system and re-draw the sidewalls to obtain this pitch.
5. Obtain other copies of Worksheets A, B, and C. Redesign the same house to include a cooling system, such as an evaporative cooling system. What factors will have to be considered for such a system?
6. Construct a model home from other materials such as wood or plaster of paris incorporating various passive solar design features.
7. Modify the activity for students with greater sophistication by encouraging precise measurement of sun angle, roof pitch, overhang length, etc.
8. Encourage the artistic student to design interior room spaces based on the best energy utilization.

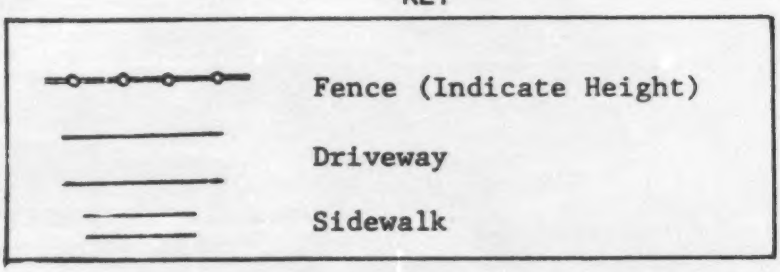
WORKSHEET A





WORKSHEET B

KEY



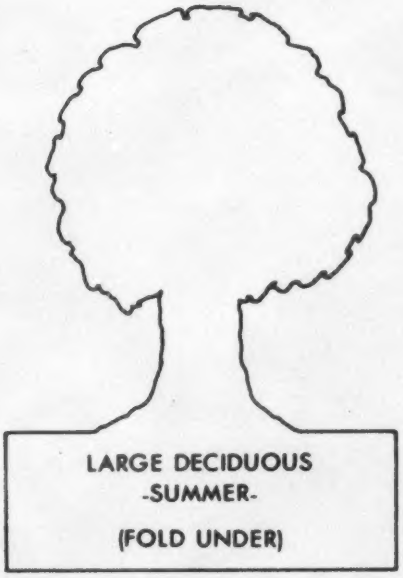
WORKSHEET C

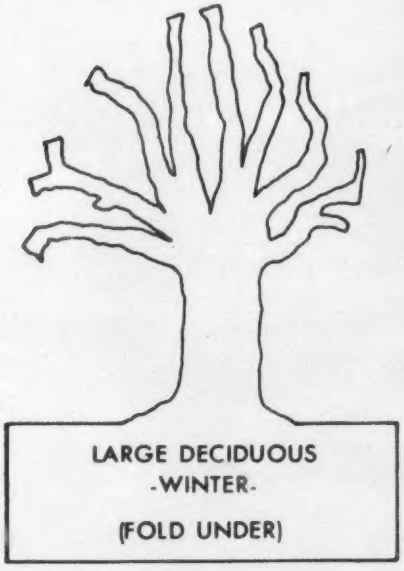
SHRUB
(FOLD UNDER)

SMALL DECIDUOUS
-SUMMER-
(FOLD UNDER)

SMALL DECIDUOUS
-WINTER-
(FOLD UNDER)

EVERGREEN
(FOLD UNDER)


LARGE DECIDUOUS
-SUMMER-
(FOLD UNDER)


LARGE DECIDUOUS
-WINTER-
(FOLD UNDER)

DEVELOPING NATIONS WANT MORE

OBJECTIVE

To discover the relationship between a nation's energy use and its standard of living.

INTRODUCING THE LESSON

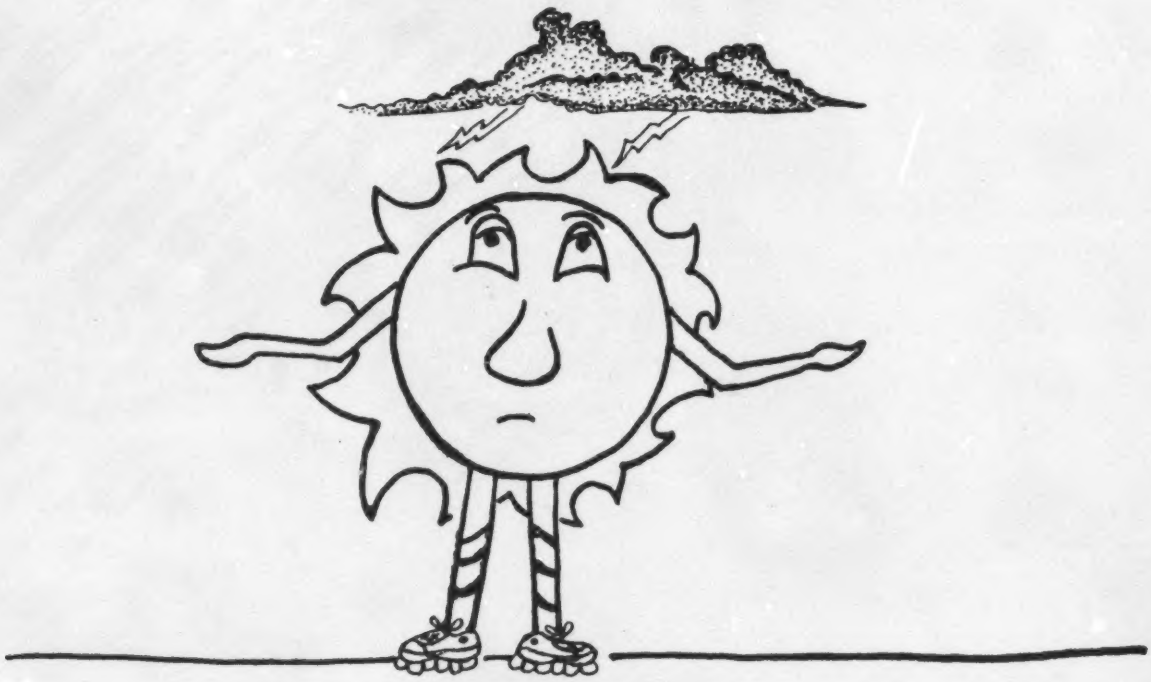
1. Review Lesson I, Unit II, on changing life patterns and the relationship between energy use and standard of living.
2. Find pictures of the "barrios" or slum communities on the outskirts of major Central and South American cities. (Caracus, Mexico City, Bogota, etc.)

DEVELOPING THE LESSON

1. At the U.N. Conference on the Human Environment in Stockholm in 1972, the developing nations insisted on consideration of the problems of the poor in getting food, water, and their needs for life from the environment -- not the pollution and energy problems of industrial nations. Discuss the work of this proposal.
2. Ask: "Is this a valid concern?"
3. Delegates from poor nations said: "We would love to have your level of pollution and the good life it represents". Ask: "Why do the poor nations of the world equate energy use, pollution, industrial development, and the "good life"?
4. What should be the response of the U.S. delegate to the conference?
5. What was the response of the U.S. delegation? (The problems of people had to be discussed at "satellite meetings", not on the official agenda.)

DEVELOPING NATIONS WANT MORE

6. Ask: "Why should a hungry person be concerned about individual and national use of energy and pollution?"
7. Discuss the validity of the claims of the developing nations to a greater share of the world's energy resources. (Most of these resources are in under-developed nations. In the past, U.S. and European oil and mining companies have exploited these resources and kept these oil and mineral-rich nations poor.)
8. How could this have happened? (Nations with the resources did not have the technology to develop their own resources.) Also, the small amounts paid for oil seemed like a lot to "poor" nations.
9. Discuss how the demands of the developing nations for a greater share of the energy (including dollars) are related to the energy "crisis".
10. Consider other contributing factors. (Middle East conflicts, international politics.)



ENERGY DEMAND AND POPULATION

OBJECTIVE

To compare the growth of population with the demand for energy in the U.S. and the world.

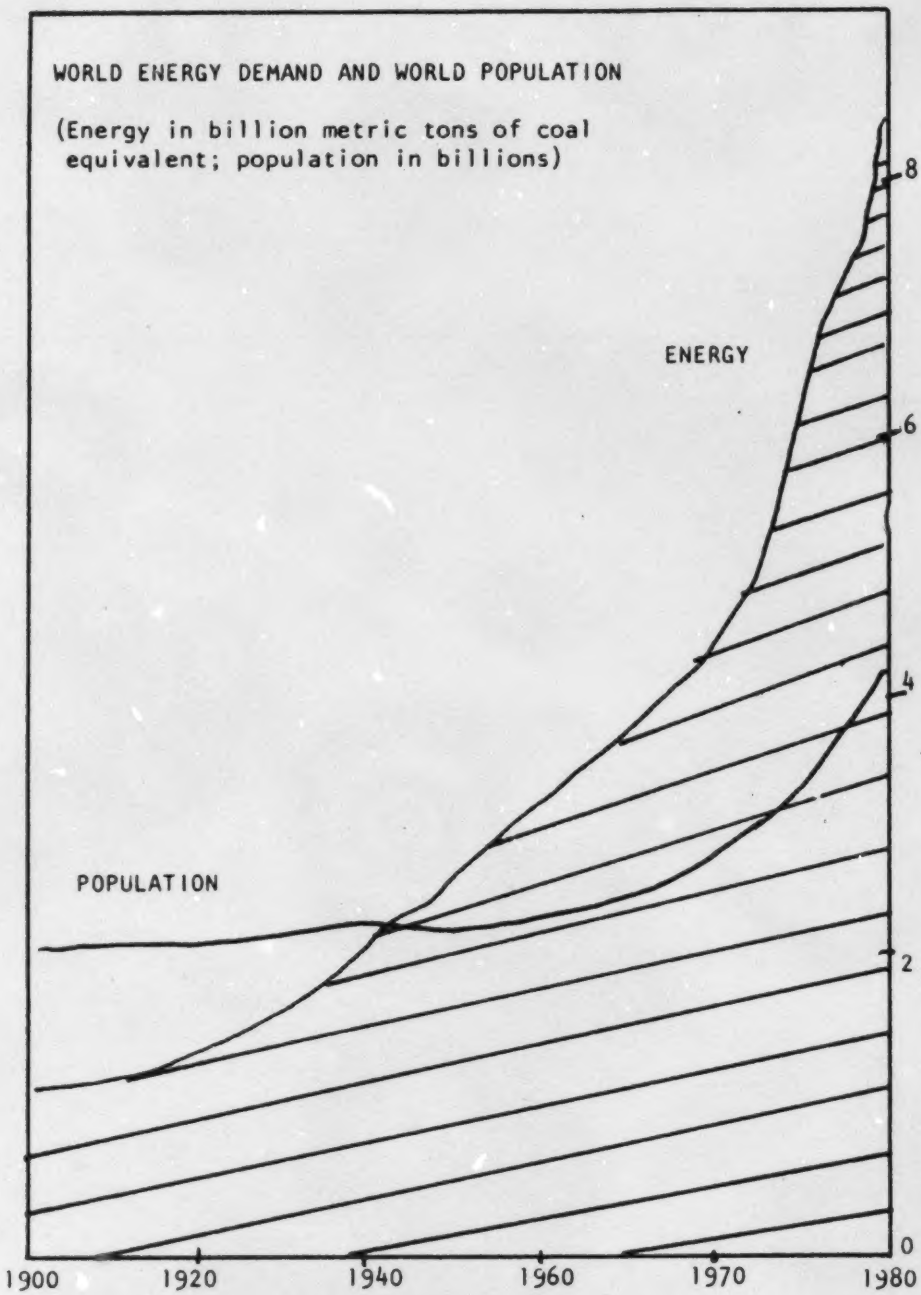
INTRODUCING THE LESSON

1. Identify the graph components (titles, bottom figures, vertical figures, population, and energy).
2. Analyze the graphs. (Population on various dates and energy demand on various dates.)

DEVELOPING THE LESSON

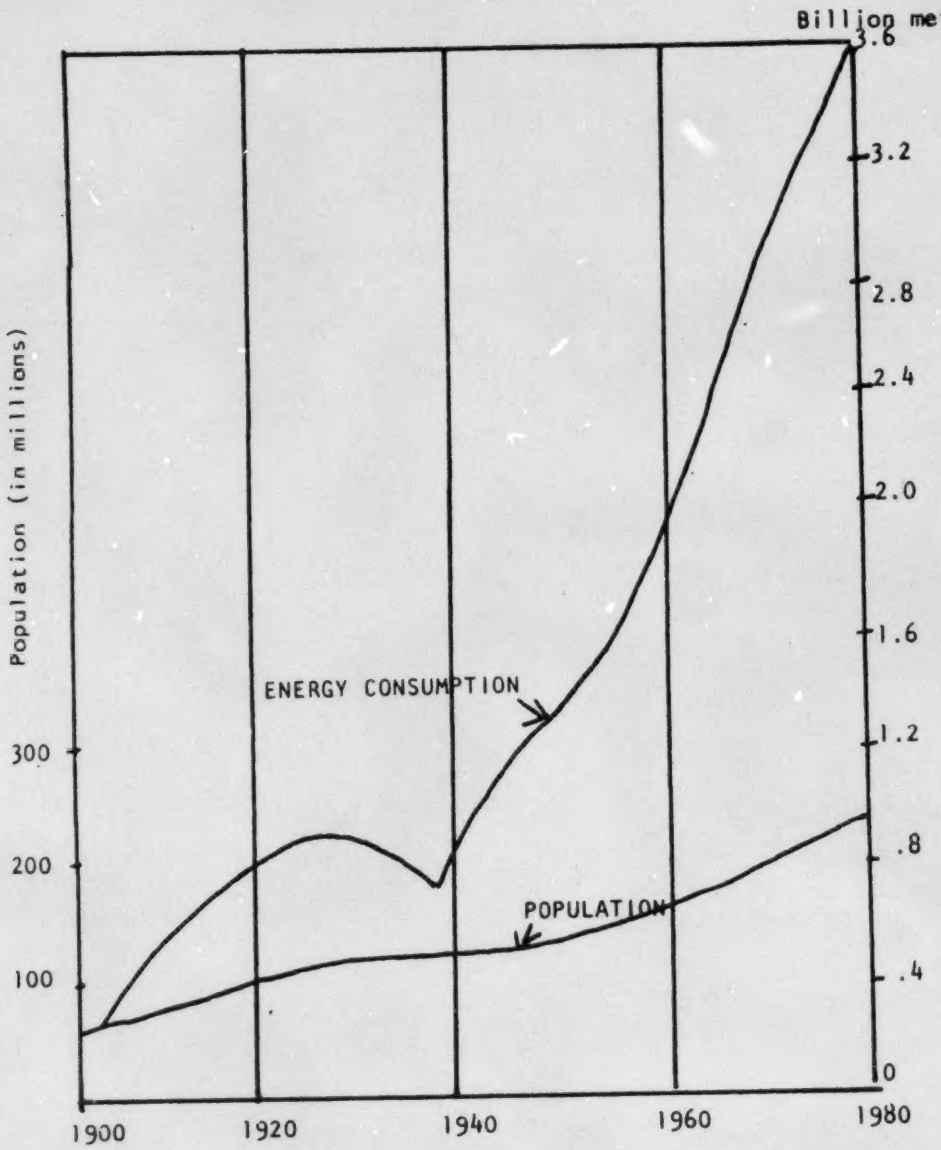
1. Approximately how much has the energy demand increased in 80 years?
2. What are some implications of the information presented in this graph?
   - The trend indicates that world energy demand will increase steadily over the next 20 years.
   - The trend indicates that world population will increase drastically over the next few years.
   - Based on past energy demands, it may be likely that energy supplies may not be able to keep up with demand.
3. Students should compare graph of U.S. with world graph.
4. Oral discussion of comparisons between the two graphs.

WORLD ENERGY DEMAND AND WORLD POPULATION*



*"Energy In The Past", World Energy Usage

U.S. POPULATION GROWTH AND ENERGY CONSUMPTION (1900-1980)



"Energy In The Past, page 12.

ENERGY USE IN NATIONS OF THE WORLD

OBJECTIVE

To discover the patterns of energy use in other nations.

INTRODUCING THE LESSON

1. Ask the students to bring in pictures of people's use of energy in other nations.
2. Make a big collage poster for each nation included in the collection of pictures. (Be prepared to fill in the blanks.)
3. Group the "developed" and the "under-developed" nations on the basis of energy use.

DEVELOPING THE LESSON

1. Consider energy use for basic needs:
   a. cooking
   b. food production
   c. shelter, including heat and light
2. List the nations that use wood as the principal cooking fuel.
3. Do the same for peat, natural gas, coal, oil, and electricity.
4. Find places that do their work by:
   a. solar energy (animal and body power)
   b. wind power
   c. water power
   d. electric power
   e. all of these
5. Investigate changes in the life-styles of people in the U.S.A. as a result of changes in primary energy sources (from wood to coal to oil to electric, nuclear, and solar).

ENERGY USE IN NATIONS OF THE WORLD

6. Do the same for people in other places -- Eskimo, Arab, Chinese, etc.

7. Predict future changes as oil supplies are depleted.